UNITED STATES OF AMERICA:
WAR DEPARTMENT.

MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

AUGUST, 1886.

PREPARED UNDER THE DIRECTION OF
BRIG. & BVT. MAJ. GEN'L W. B. HAZEN,
CHIEF SIGNAL OFFICER OF THE ARMY,

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1886.

List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of August, 1886.

Name of vessel.	Captain.
Allan Line.	
Br. s. s. Canadian	Capt. J. Kerr.
Circassian	Wm. Richardson.
Grecian	C. E. LeGallais.
Nova Scotian	R. H. Hughes.
American Line.	
Br. s. s. British King	John Kelly.
British Princess	E. H. Freeth.
Am. Indiana	R. W. Sargent.
Br. Lord Clive	P. Urquhart.
Ocean Prince	W. J. Milburn.
Anchor Line.	
Br. s. s. Anchoria	J. J. Small
British Crown	Archibald Smith.
Circassia	A. Campbell.
City of Rome	R. D. Munro.
Devonia	Hugh Young.
Dorian	J. McKeague.
Furnessia	J. Heidderwick.
Ethiopia	John Wilson.
Arrow Line.	
Br. s. s. Critic	W. B. Lord.
Monte Rosa	C. Thomas.
Atlas Line.	
Br. s. s. Alba	J. W. Sansom.
Span. Alpes	T. Anasagasti.
Br. Alvena	G. Hughes.
Alvo	David Williams.
Claribel	T. M. MacKnight.
Booth's S. S. Co. (limited).	
Br. s. s. Clement	Thomas Burley.
Jerome	Benj. Crimp.
Bordeaux Steam Navigation Company.	
Fr. s. s. Chateau Yquem	C. Journeil.
Bridal City Line.	
Br. s. s. Brooklyn City	W. Flitt.
Wells City	T. L. Weise.
Cromwell Line.	
Am. s. s. Louisiana	E. V. Gager.
Cunard Line.	
Br. s. s. Aurania	W. H. P. Hains.
Catalonia	Alex. McKay.
Etruria	T. Cook.
Gallia	M. Murphy.
Pavonia	B. Woolfenden.
Scythia	T. Roberts.
Servia	H. McKay.
Umbria	W. McMicken.
Edward Oser's S. S. Line.	
Ger. s. s. Amalfi	Julius Bahr.
Australia	G. Frank.
Polynesia	A. Kuhn.
Furness Line.	
Br. s. s. Borderer	F. Manley.
Boston City	W. T. Sherborne.
Durham City	M. P. Land.
General Trans-Atlantic Steamship Co.	
Fr. s. s. La Bourgogne	Franguel.
La Bretagne	M. de Jonsselin.
La Champagne	E. Traub.
La Normandie	G. de Kersabiec.
Great Western S. S. Line.	
Br. s. s. Dorset	Ch. Off. E. Crossman.
Saxmundham	Capt. T. M. Milne.
Warwick	W. Jones.
Guion Line.	
Br. s. s. Alaska	G. O. Murray.
Arizona	S. Brooks.
Nevada	John Douglas.
Wisconsin	Edward Bentley.
Wyoming	C. L. Rigby.
Hamburg-American Line.	
Ger. s. s. Bohemia	B. Kuriowa.
Gellert	W. Kühlewein
Hammonia	H. F. Schwensen.
Lessing	H. Barends.
Rhaetia	H. Vogelgesang.
Rugia	A. Albers.
Servia	C. Ludwig.
Wieland	C. Helrich.
Westphalia	Droescher.
Inman Line.	
Br. s. s. City of Berlin	Francis S. Land.
City of Chester	A. Lewis.
City of Chicago	Fred Watkins.
Lamport & Holt's Steamship Company.	
Br. s. s. Biela	Fred Graham.
Olbers	Jas. Clarke.
Monarl	T. Sawyer.
Legland Line.	
Br. s. s. Bavarian	R. Leach.
Bulgarian	E. Parry.
Virginian	M. Flitt.
Mallory Line.	
Am. s. s. Alamo	S. Risk.
San Marcos	A. C. Burrowe.
Mac. & Dominion S. S. Co.	
Br. s. s. Montreal	F. Bourchette.
Ontario	W. P. Couch.
Sarnia	Joseph Gibson.
Toronto	Jas. McAuley.
Monarch Line.	
Br. s. s. Assyrian Monarch	John Harrison.
Celtic Monarch	J. Hilditch.
Lydian Monarch	T. C. Huggett.
Persian Monarch	F. Paton.
Morgan Line.	
Am. s. s. Eureka	R. B. Quick.
National Line.	
Br. s. s. America	R. W. Grace.
Canada	Thos. Foote.
Denmark	R. S. Rigby.
Egypt	J. Sumner.
England	T. F. Healey.
Greece	A. J. Jeffrey.
National Line—Continued.	
Helvetia	Capt. G. Cochrane.
Holland	W. Tyson.
Italy	W. Pearce.
The Queen	J. Milligan.
New York and Cuba Mail S. S. Co.	
Am. s. s. Cienfuegos	F. M. Faircloth.
N. Y., Havana & Mexican Mail S.S. Co.	
Am. s. s. City of Alexandria	J. W. Reynolds.
City of Washington	W. M. Rittig.
North German Lloyd Steamship Co.	
Ger. s. s. America	H. Bodeker.
Donau	H. Swpner.
Eider	H. Holmore.
Elbe	H. Christoffers.
Ems	T. Jungst.
Fulda	R. Ringk.
Hermann	Kohlmann.
Leipzig	H. Christoffers.
Main	R. Sander.
Rhein	C. Wiegand.
Trave	W. Willigerod.
Werra	R. Buselus.
Weser	H. Bruns.
Ocean Steamship Company.	
Am. s. s. Chattahoochee	J. W. Catharine.
City of Augusta	K. S. Nickerson.
City of Savannah	Ch. Off. Edwards.
Oceanic Steamship Company.	
Am. s. s. Mariposa	Capt. H. M. Hayward.
Old Dominion Steamship Company.	
Am. s. s. Manhattan	Frank Stevens.
Oregon Railway and Navigation Co.	
Am. s. s. Columbia	Fred Bolles.
Oregon	E. Polemann.
Pacific Coast Steamship Company.	
Am. s. s. Orizaba	John N. Ingalis.
State of California	G. Dobney.
Pacific Mail Steamship Company.	
Am. s. s. City of Para	F. Henderson.
City of Sydney	Daniel Friele.
Colon	Chas. C. Lima.
Granada	W. D. Seabury.
San Blas	T. Chapman.
Quebec Steamship Company.	
Br. s. s. Muriel	G. S. Locke.
Orinoco	J. S. Garvin.
Trinidad	W. J. Fraser.
Red "D" Line.	
Am. s. s. Philadelphia	Sam. Hess.
Red Star Line.	
Belg. s. s. Belgenland	W. A. Beynon.
Nederland	A. G. Griffin.
Noordland	H. E. Nickels.
Pennland	Rud. Weyer.
Rhyland	J. C. Jamison.
Waesland	J. Uberweg.
Westernland	Com. W. G. Randle.
Rotterdam Line.	
Dtch. s. s. Edam	Capt. J. H. Taat.
P. Caland	T. H. Boujer.
Schiedam	G. Bakker.
W. A. Scholten	G. J. Vis.
State Line.	
Br. s. s. State of Georgia	G. Moodie.
State of Pennsylvania	A. J. A Mann.
State of Nebraska	A. G. Brass.
Thingvalla Line.	
Dan. s. s. Geiser	C. W. Möller.
Hekla	A. G. Thomsen.
Island	W. Skjödt.
Twin Screw Line.	
Br. s. s. Richmond Hill	A. Hyde.
Tyne & Wear Steamship Co.	
City of Newcastle	W. T. Irving.
United States and West Indies S. S. Co.	
Am. s. s. Jessie	W. A. Freethy.
Warren Line.	
Br. s. s. Iowa	Samuel Walters.
Kansas	W. Gleig.
Norseman	E. Maddox.
West Indian and Pacific Steamship Co.	
Br. s. s. Yucatan	S. S. Sandroy.
White Cross Line.	
Belg. s. s. De Ruyter	J. J. Brarens
White Star Line.	
Br. s. s. Adriatic	H. Parsell.
Baltic	George Burton
Celtic	B. Gleadell.
Germanic	C. W. Kennedy.
Wilson Line.	
Br. s. s. Bassano	W. Eee.
Buffalo	J. H Malet.
Chicago	J. W. Jones.
Galileo	R. Potter.
Marengo	W Abbott.
Miscellaneous.	
Br. s. s. Aberaeron	Jno. Temple.
Ada	E. Garner.
Nor. Amicitia	P. L. Reimers.
Br. Athens	Ch. Off. E. Towne.
Bedford	Capt. Thos. Aitkenhead
Craighill	W. H. Bennett.
Cranbrook	John W. Harvey.
Edith Godden	John H. Bennett.
El Callao	J. Scholtz.
Br. s. s. Elstow	T. Robertson.
Span. Hugo	A. de Magica.
Joshua Nicholson	S. Adamson.
Am. Lorenzo D. Baker	Warren F. Wiley.
Br. Madrid	M. Garson.
Matthew Bedlington	Thomas Kirby.
Span Navarre	S. de Aldecoosa.
Ger. Raiatea	J. Viereck.
Br. s. s. Saint Ronans	N. Campbell.
— Stag	Jas. Adams.
Miscellaneous—Continued.	
Br. s. s. Sulina	Capt. Thos. Potter.
Vindobana	Thos. Harrison.
"New York Herald Weather Service."	
Br. Adriatic	H. Parsell.
Allsa	J. W. Sansom.
Am. Alamo	S. Risk.
Br. Alaska	G. S. Murray.
Aller	F. Hanchmann.
Alpes	Anasagasti.
Alvena	O Hughes.
Aurania	W. H. P. Hains.
Alvo	D. Williams.
Anchoria	J. J. Small
Arizona	Sam. Brooks.
Assyrian Monarch	J. Harrison.
Belgenland	W. A. Beynon.
Br. Britannic	P. J Irving.
Buffalo	W. H. Malet.
Celtic	B Gleadell
Am. Cienfuegos	F. M. Faircloth
City of Berlin	F. S. Land.
City of Chester	H. Condrun.
Br. City of Richmond	A. Lewis.
City of Rome	R. D. Munro.
Am. City of Washington	W. H. Rittig.
Comal	Chas. C. Lima.
Comal	Bolger.
Br. Craighill	W. H. Bennett.
Devonia	H. Young.
Ger. Donau	H. Swpner.
Eider	H. Heimers.
Br. Edith Godden	J. H. Bennett.
Ethiopia	J. Wilson.
Etruria	T. Cook.
Ger. Ems	W. Willigerod.
Am. Eureka	R. B. Quick.
Ger. Fulda	R. Ringk.
Br. Gallia	M. Murphy.
Ger. Gellert	W. Kuhlewein
Br. Greece	A. J. Jeffrey.
Fr. La Bourgogne	Franguel
La Bretagne	de Jusselin.
La Normandie	de Kersabiec.
Am. Lampasas	Mason.
Lone Star	Gager.
Louisiana	F. Stevens.
Manhattan	Benton.
Br. Miranda	W. G. Shackford.
Am. Newport	Remis.
Niagara	H. E. Nickels.
Belg. Noordland	Boujer.
Dtch. P. Caland	R. Weyer.
Belg. Pennland	Hess.
Am. Philadelphia	C. Wiegand.
Ger. Rhein	A. Hyde.
Br. Richmond Hill	A. Albers.
Ger. Rugia	J. C. Jamison.
Belg. Rhyland	A. C. Burrows.
Am. San Marcus	G. Bakker.
Dtch. Schiedam	A. McKay.
Br. Servia	A. G. Brass.
State of Nebraska	J. J. A. Mann.
State of Pennsylvania	J. Milligan.
The Queen	W. Willigered.
Ger. Trave	J. Uberweg
Warwick	Com. W. G. Randle.
Belg. Waesland	Capt. E Boutley.
Br. Westernland	C. L. Rigby.
Wisconsin	*Sailing vessels.*
Wyoming	Am. bg. Abbie Clifford
Sailing vessels.	Br. bg. Achoah
Am. bg. Abbie Clifford	Am. schr. Bertram L. Townsend
Br. bg. Achoah	Br. sp Cesares
Am. schr. Bertram L. Townsend	Br. sp. Charles S. Whitney
Br. sp Cesares	Am. schr. Comet
Br. sp. Charles S. Whitney	Gr. bk Emilio
Am. schr. Comet	Am. schr. Ettie H. Lister
Gr. bk Emilio	Br. bk. Exile
Am. schr. Ettie H. Lister	Ger. sp. Georg
Br. bk. Exile	Ger. bk. Godeffroy
Ger. sp. Georg	Nor. bk. Grandloven
Ger. bk. Godeffroy	Am. bk. Harriet S. Jackson
Nor. bk. Grandloven	Br. Harvester
Am. bk. Harriet S. Jackson	Ger. sp. Hedwig
Br. Harvester	Dtch. bk. Helena
Ger. sp. Hedwig	Am. sp. Henry Villard
Dtch. bk. Helena	Br. bk. Iodine
Am. sp. Henry Villard	It. bk. Ismaele
Br. bk. Iodine	Am. bg. Jane Adeline
It. bk. Ismaele	schr. Jennie A. Stubbs
Am. bg. Jane Adeline	bkt. Josephine
schr. Jennie A. Stubbs	Br. bk. Kryolith
bkt. Josephine	Nor. sp Komandor Svend Foyn
Br. bk. Kryolith	Ger. bk. Leocadia
Nor. sp Komandor Svend Foyn	Br. bg. Lilian
Ger. bk. Leocadia	sp. Mabel Taylor
Br. bg. Lilian	Am. schr. Maggie Abbott
sp. Mabel Taylor	Nor. sp. Mathilda
Am. schr. Maggie Abbott	Am. bk. Mohican
Nor. sp. Mathilda	schr. Nelson Bartlett
Am. bk. Mohican	Nor. sp. Orion
schr. Nelson Bartlett	Dan. bk. Rialto
Nor. sp. Orion	Ger. Richard
Dan. bk. Rialto	Am. sp. Ringleador
Ger. Richard	schr. Rollin Sanford
Am. sp. Ringleador	Br. sp. Sapphire
schr. Rollin Sanford	Am. bk. Templar
Br. sp. Sapphire	Ger. sp. Union
Am. bk. Templar	It bk. Vincenzo Accame
Ger. sp. Union	Ger. Western Chief
It bk. Vincenzo Accame	Am. schr. W. H Fredson
Ger. Western Chief	Br. sp. Winnifred
Am. schr. W. H Fredson	Am. Light-Ship No. 37
Br. sp. Winnifred	
Am. Light-Ship No. 37	

MONTHLY WEATHER REVIEW.

VOL. XIV. WASHINGTON CITY, AUGUST, 1886. No. 8.

INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during August, 1886, based upon the reports from the regular and voluntary observers of the Signal Service and from co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i. Two hurricanes which passed over the Caribbean Sea and the Island of Cuba are also traced and described. In tracing the centres of the paths of these storms, data from the reports of one hundred and eighty-two vessels have been used.

On chart i for this month are traced the paths of fourteen areas of low pressure; the average number for August during the last thirteen years being only 9.5. The storm described as number viii was very destructive in eastern Texas on the 19th and 20th, doing great damage in Galveston, and completely destroying the town of Indianola. On this chart is also given a diagram showing the barometric conditions prevailing in the immediate vicinity of Indianola at 7 a. m. of the 20th, at which time the storm was central near that place.

The report by Prof. T. C. Mendenhall, Assistant, on the earthquake which occurred on the 31st of August in the eastern portion of the United States, is an interesting feature of this REVIEW. The report is based upon data collected from Signal Service observations, thunder-storm and tornado reports, and other sources. The reports from the regular Signal Service observers were specially valuable in determining the time of occurrence and intensity of the shock in different portions of the country. Chart number vii exhibits lines of equal intensity of the shock as determined from a careful examination of the data.

Chart number viii shows the atmospherical conditions, isobars, isotherms, and wind-directions accompanying the tornadoes in western New York on August 16th, at 3 p. m.

The drought in the central sections was broken on the 12th and 13th by the copious rainfalls accompanying the heavy thunder and wind storms that occurred in nearly all parts of the afflicted districts on those days.

The mean atmospheric pressure for the month is below the normal in nearly all parts of the country.

In all parts of the country lying east of the Mississippi River, and in Louisiana and eastern Texas, the mean temperature of the month is below the normal. From the Mississippi River westward to the Pacific Ocean the month has been warmer than the average August.

The precipitation is very unequally distributed, marked departures, both above and below the normal, occurring at adjacent stations.

No icebergs were reported in, or to the southward of, the trans-Atlantic track after the 24th, and but few were encountered in, and to the eastward of, the Strait of Belle Isle and Newfoundland during the early portion of the month.

In the preparation of this REVIEW the following data, received up to September 20, 1886, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty-two Canadian stations, as telegraphed to this office; one hundred and fifty-nine monthly journals; one hundred and fifty-three monthly means from the former, and twenty-two monthly means from the latter; two hundred and seventy-five monthly registers from voluntary observers; sixty-two monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Alabama, Georgia, Indiana, Iowa, Missouri, Nebraska, New England, Ohio, and Tennessee; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE.

[Expressed in inches and hundredths.]

The distribution of mean pressure for August, 1886, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

The mean atmospheric pressure for the month is very equally distributed over the country. An area of comparatively high pressure extends over the Lake region, middle Atlantic states, south Atlantic states, northern Florida, east Gulf states, Tennessee and Ohio Valley; within the above districts the barometric means for the month vary from 29.95 at numerous stations to 30.01 at Nashville, Tennessee. Another area of high pressure extends along the north Pacific coast, within this area the mean pressure varies from 29.96 at Portland, Oregon, to 30.00 at Fort Canby, Washington Territory. The area of minimum pressure ranges from 29.80 to 29.85, and covers Nevada, western Utah, western Arizona, and eastern California. An area of low pressure, indicated by the isobar of 29.85, extends over the lower Saint Lawrence valley.

The departures, which are nowhere very great, are in almost every case below the normal. The mean pressure is above the normal for August at three stations only, viz., Fort Apache, Arizona, Deadwood, Dakota, and Cedar Keys, Florida, .02, .01, and .01, respectively. In the Lake region, New England, and the middle and south Atlantic states, the mean pressure for the month shows a deficiency of about .05, although at Sandy Hook and Atlantic City, New Jersey, the departures are .08 and .07, respectively. Along the Pacific coast the deficiencies range from .02 to .07. The largest departures occur in the Missouri Valley, where they vary from .06 to .09. Slight deficiencies occur over all other portions of the country, and vary from .01 to .08.

As compared with the mean pressure for the preceding month, July, 1886, an increase, varying from .01 to .09, occurs in all parts of the United States, except along the Pacific coast and in southern Florida, where a deficiency of .01 to .04 occurs.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are also given in the table of miscellaneous data. The greatest ranges occurred in New England, the middle Atlantic states, and in Montana, although, owing to the heavy storm of the 19th and 20th in southeastern Texas, a very large range occurred at San Antonio. Along the Pacific coast and in the southern districts the barometric ranges were generally small.

The following are some of the extreme monthly ranges:

Greatest.	Inch.	Least.	Inch.
San Antonio, Texas	1.41	Cape Mendocino, California	0.20
Mount Washington, New Hampshire	1.04	Red Bluff, California	0.25
Eastport, Maine	0.99	Sacramento, California	0.26
Portland, Maine	0.93	San Diego, California	0.27
Boston, Massachusetts	0.90	Fort Davis, Texas	0.28
Block Island, Rhode Island	0.84	Fort Sill, Indian Territory	0.28
New London, Connecticut	0.82	Frisco, Utah	0.29

AREAS OF HIGH PRESSURE.

[Prepared by Lieut. JNO. P. FINLEY, Signal Corps, U. S. Army, Assistant.]

Six areas of high pressure appeared within the limits of the United States during the month of August, 1886. With but two exceptions these areas made their first appearance north of 45° N., and between 107° and 112° W. The general direction of movement was invariably southeastward until the Atlantic coast was reached, when the direction changed to the east-northeast, skirting the coast.

Two areas first appeared north of Lake Superior, moving southeastward to central New York, and thence east-northeast, south of Nova Scotia.

Of all the areas described below, there is but one (number vi) of any special importance, rendered so by the low temperatures and heavy frosts which accompanied its progress over the upper Missouri valley and Minnesota. It may be said that with but two exceptions (areas numbers iv and vi) the month of August, 1886, was entirely devoid of high-pressure areas, yet, even with these exceptions, no area of 30.20 crossed the country.

I.—The month opened with the barometer considerably above the normal in Montana, Dakota, and the Saskatchewan Valley. On the 2d this area moved to the southeastward, attended with light rains in Dakota and Nebraska, and a thunder-storm in the latter state. During the 3d the central area reached northern Indiana, after which it spread out rapidly to the east, west, and south, and by the morning of the 4th had entirely lost its identity. During the advance of this area the change in temperature was very slight, except over the Lake Superior region.

II.—This area advanced from the Northwest, with a very ill-defined and uncertain movement. Since the morning of the 4th the pressure in Montana, and westward to the Pacific, had been subjected to many and considerable fluctuations, but by the morning of the 6th a decided rise appeared central in eastern Colorado and western Nebraska; highest barometer, 30.18, at West Las Animas, Colorado, and North Platte, Nebraska. The advance of this area was preceded by light rains southward into Texas.

During the 6th and 7th the area passed eastward into Kentucky, with rapidly diminishing energy, under the influence of low-pressure area number iii advancing from Montana, but as this depression lost its identity in Minnesota on the 8th the effect produced upon the high was only temporary, so that by the morning of the 9th the isobar of 30.30 embraced the middle Atlantic states; highest barometer, 30.33, at Washington City, Baltimore, Maryland, and Philadelphia, Pennsylvania. On the 10th the barometer fell to 30.20, the isobar of that notation embracing the Gulf and Atlantic coast states. As low area number iv advanced eastward north of the Lakes the high was confined to the Gulf States, where it remained about stationary during the 11th, and disappeared on the morning of the 12th.

III.—This area appeared over Lake Superior on the morning of the 14th and moved southeastward into eastern Pennsylvania by midnight of the following day, disappearing south of Nova Scotia during the afternoon of the 16th. Throughout the entire course of this area the barometer did not rise at any station above 30.11.

IV.—The pressure increased very slowly in the rear of low area number vi, which appeared in western Nebraska on the 15th. On the morning of the 17th, when the depression here mentioned was central on the southwest coast of Nova Scotia, the high appeared central in northern Dakota and the Saskatchewan Valley, with northerly winds, and temperature ranging from 38° to 52°. With increasing pressure the area became central over Lake Superior on the morning of the 18th; highest barometer, 30.28, at Duluth, Minnesota. The northerly winds in advance of the centre were attended with light local rains throughout the central portions of the country, from Kansas eastward to the Atlantic coast. The high advanced steadily eastward to the Atlantic coast with very slight change in pressure at the centre, but rapidly enlarging its area so that by the morning of the 20th, while central off the Maine coast (highest barometer, 30.38, at Yarmouth, Nova Scotia), the isobar of 30.10 embraced nearly the entire country east of the eighty-seventh meridian. The barometer remained above 30.30 off the Nova Scotia coast until the afternoon of the 21st, and at the expiration of the succeeding twenty-four hours the area entirely disappeared to the eastward.

V.—While low-pressure area number xii was advancing eastward from Montana on the 24th and 25th the barometer rose over the upper lakes, so that by the morning of the latter day the isobar of 30.10 embraced the greater portion of the Lake region; highest barometer, 30.16, at Toledo, Ohio. The area now moved southeastward into Pennsylvania and Virginia with gradually diminishing energy, where by the afternoon of the 27th it entirely disappeared, but not until the isobar of 30.00 had embraced all of the territory east of the Mississippi and south of the forty-fifth parallel.

VI.—This area appeared central in western Montana on the morning of the 29th, highest barometer, at Helena, Montana, 30.23. During the succeeding twenty-four hours the pressure at the centre remained nearly stationary while the extent of the area rapidly increased to the southeastward, reaching northern Texas. During the 30th there was practically no eastward movement of the centre, it being confined to either eastern Montana or western Dakota. During the stationary period the temperature was gradually falling at most stations in Montana, the Saskatchewan Valley, and northern Dakota, and by the morning of the 31st the area became central in southeast Dakota; highest barometer, at Huron, Dakota, 30.20. Accompanying this advance of the high the temperature fell from 8° to 15°, although for the previous twenty-four hours it had been decidedly below the normal, and as a result light to heavy frosts were reported from eastern Dakota, western and northern Minnesota, western Iowa, and eastern and northern Nebraska. A killing frost was reported from Huron, Dakota, the station where the highest barometer was recorded and the centre of the area of high located on the morning chart of the 31st. During this day the area rapidly enlarged in extent, forming an ellipse, the major axis of which extended from the northern shore of Lake Superior to the Gulf. By midnight of the 31st the centre was located in eastern Illinois, with diminished pressure, where at the close of the month the progressive movement of the area was eastward over the Ohio Valley and middle Atlantic states.

AREAS OF LOW PRESSURE.

[Prepared by Lieut. JNO. P. FINLEY, Signal Corps, U. S. Army, Assistant.]

Fourteen areas of low pressure have been located within the

limits of the Signal Service tri-daily weather charts for the month of August, 1886. The month has not been marked by the appearance of remarkable features in the development and progress of low-pressure areas. The storm of the 19th and 20th, in the western Gulf and Texas, was one of great severity and rather exceptional movement, yet not remarkable for the month, when it is considered that the last half of August is generally the beginning of the period of cyclonic disturbance in the West Indies and Gulf of Mexico.

With few exceptions the areas of barometric minima developed on the eastern slope of the Rocky Mountains and passed eastward over the Lake region north of the forty-third parallel, reaching the Atlantic coast in the vicinity of Newfoundland.

The following table shows the latitude and longitude in which each area was first and last observed, with the average rate of movement in miles per hour:

Areas of low pressure.	First observed.		Last observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
	° ′	° ′	° ′	° ′	
No. I	44 00	75.00	47 00	58 00	23.0
II	33 00	83 00	40 00	73 00	22.0
III	51 00	106 00	48 00	96 00	29.0
IV	50 00	112 00	47 00	57 00	40.0
V	48 00	107 00	49 00	59 00	53.0
VI	44 00	102 00	44 00	61 00	55.0
VII	39 00	97 00	32 00	92 00	.....
VIII	27 00	92 00	31 00	100 00	16.0
IX	50 00	102 00	42 00	77 00	30.0
X	42 00	68 00	46 00	57 00	31.0
XI	46 00	107 00	50 00	97 00	28.0
XII	47 00	105 00	50 00	60 00	48.0
XIII	51 00	67 00	46 00	58 00	.....
XIV	38 00	105 00	50 00	62 00	31.0

Average hourly velocity, 34.0 miles.

I.—On the morning of the 1st there was a general but slight depression of the barometer, extending in a narrow belt northeastward from northern Texas to the lower Saint Lawrence, with local rains in Tennessee, Ohio, and the lower lakes. By afternoon the depression became more circumscribed, with the centre located in northern New York. The rain-area extended from Arkansas and Missouri northeastward to New Hampshire. During the day very heavy rains fell in western Tennessee and eastern Arkansas, over which region the long trough-like depression extended to the southwestward. During the afternoon of the 1st severe local storms occurred in southern Michigan and northwestern Ohio. The low area now moved rapidly northeastward to the Gulf of Saint Lawrence where it lingered during the 3d, with light but general rains and light to brisk winds.

II.—From the morning of the 1st to the 6th light local rains were of daily occurrence in Alabama, northern Florida, Georgia, and South Carolina, with continued but not decided changes in the pressure. During the 6th, however, the barometer continued to fall and a slight irregular depression formed in the Carolinas, accompanied by light rains and light to brisk winds. This area passed off the coast at Norfolk, Virginia, on the night of the 6th, with brisk to high east to north winds and heavy rains. During the 7th it disappeared eastward off the New Jersey coast, with high northeasterly winds and heavy rains, the latter extending to Boston, Massachusetts, and general rains, with fresh to brisk northerly winds to the stations on the Nova Scotia coast.

III.—The barometer had been falling slowly in the Saskatchewan Valley since the morning of the 5th so that by midnight of the 6th a depression was central in about 51° N., 106° W., with light winds and no precipitation. During the 7th the area moved south and east into northern Minnesota, where on the morning of the 8th its easterly movement was checked by the development just at this time of area number iv north of Montana. On the afternoon and evening of the 7th there was a thunder-storm and heavy rain at Huron, Dakota; otherwise there was no precipitation during the formation and progress of this area.

IV.—During the 8th heavy rains and thunder-storms prevailed in eastern Nebraska, southeastern Dakota, and northern Minnesota, with winds shifting to southerly. By midnight of this date the centre of the depression appeared in about 50° N., 112° W., with no precipitation. During the 9th it moved easterly north of the United States, attended by fresh to brisk south winds and light rains in northern Dakota and local storms in northern Minnesota. On the 10th, while the centre was north of the Lakes, light local rains and southerly winds prevailed over that region. During the 11th the depression moved rapidly eastward to the Gulf of Saint Lawrence with fresh to brisk winds and occasionally heavy rains, disappearing to the eastward over Newfoundland on the following day. While the depression was passing eastward north of New York violent local storms occurred in the western portion of that state.

V.—This depression appeared on the morning of the 12th in Montana, with fresh to brisk winds but no precipitation. By midnight light local rains had fallen in Dakota and southeastern Montana, and the small area which sixteen hours before was confined to central Montana had now elongated into a large trough extending southward into New Mexico. On this afternoon violent local storms and tornadoes occurred in southeastern Dakota. This condition became more decided on the 13th, and the trough now extended from the Rio Grande to Lake Superior, with two storm-centres, one in northern Wisconsin and the other in Nebraska. The latter remained about stationary for the succeeding twenty-four hours and finally filled up. The former passed eastward north of the lower lakes with occasional heavy rains and fresh to brisk winds on the 13th. During the 14th the depression moved rapidly east and northeast to the Gulf of Saint Lawrence, disappearing over Newfoundland on the following morning.

VI.—This depression appeared on the afternoon of the 15th in western Nebraska and southwestern Dakota, and during the remainder of the day elongated to the northeast and southwest so as to embrace Minnesota, Kansas, and Colorado. In connection with this change in the form of the depression there occurred very violent and destructive local storms, principally hail, in eastern Dakota and Minnesota. On the 16th the depression still maintained an elongated form, but changed the direction of its major axis so as to lie more nearly east and west. This feature was very decidedly marked during the afternoon and evening, so that while the principal storm-centre was over Lake Erie the depression extended from northern New York westward to Utah. On this afternoon violent local storms occurred in eastern Ohio, western Pennsylvania, and tornadoes in western New York. On the morning of the 17th there was still a trough-like depression of 29.90, extending westward to Kansas, within which region there were occasionally heavy rains and thunder-storms. During the day the depression moved eastward over New England, and by midnight disappeared off the Nova Scotia coast. Very heavy rains fell at stations on the latter coast, and also on the Maine coast, but the winds were only fresh to brisk.

The following notes from Signal Service observers are of interest:

Davenport, Iowa: on the 12th a thunder-storm, with light rain, prevailed from 5.30 to 5.55 p. m., followed by a high southwest wind of thirty-two miles per hour from 5.40 to 6.35 p. m.

Sandusky, Ohio: on the 13th a thunder-storm and heavy rain began at 5.40 and continued until 7.05 a. m. Brisk to high winds prevailed from 5.40 to 6.30 a. m.

By reference to the descriptions of storms in this REVIEW under the headings of "Local storms and tornadoes" and "Thunder-storms for August, 1886," it will be seen that many thunder-storms occurred on the 12th and 13th in the sections over which this low area prevailed.

VII.—It was in consequence of the great elongation to the westward of number vi that impetus was given to the development in eastern Kansas on the 17th of low-pressure area number vii. On this afternoon severe local storms occurred in

southern Missouri, and thunder-storms in Tennessee, Kansas, and Colorado. The depression progressed very slowly southeastward, with diminishing energy, and finally disappeared altogether by the morning of the 19th in northern Louisiana. There was at that time a violent storm (number viii) moving westward over the Gulf in about 25° N., 90° W., but there is no evidence to indicate that number vii merged with that depression.

VIII.—The first indication of this depression is given by the steamship "San Marcos," of the Mallory Line, which plies between New York City and Galveston, Texas. This steamer left the latter port on the 18th. On the following day, in 27° 55′ N., 91° 22′ W., the following observation was made: barometer, 29.84; temperature, 84°; wind, east; force, 6; frequent squalls with very heavy southeast swell. Owing to the rough weather very little headway was made, so that on the 20th the ship was in 27° 23′ N., 89° 21′ W., where the barometer read 29.92, temperature 84°, wind southeast by east, force 4; frequent squalls with long east-southeast swell.

On the morning of the 19th the winds at stations on the west Gulf coast had shifted to northerly and increased from light to brisk. By midnight the wind fell to a dead calm at Galveston, Texas, but increased to forty miles per hour from the northeast at Indianola, Texas, where the barometer registered 29.76, a fall of .09 since 7 a. m. At Brownsville, Texas, the barometer read 29.69, a fall of .15 since 7 a. m. At the expiration of the next eight hours the barometer fell to 28.89 at Indianola, Texas, a change of .87, wind northeast, seventy-two miles. The building occupied by the observer was crushed to pieces, causing the death of the latter. The whole town was given over to the fury of the elements, and not a building was left standing when the storm cleared away.

While the storm was thus raging at Indianola (7 a. m. of the 20th), the surrounding stations rendered the following reports: Galveston, barometer, 29.67; wind, northeast; forty-nine miles; clear; maximum velocity since midnight, fifty-three miles. Brownsville, barometer, 29.63; temperature, 78°; wind, northwest; eight miles; fair. Rio Grande City, barometer, 29.71; thermometer, 77°; wind, northwest; eight miles; cloudy. San Antonio, barometer, 29.69; temperature, 79°; wind, northeast; twenty miles; cloudy.

The storm had now left the Gulf and was moving northwestward over Texas, in the direction of San Antonio, at which place by 11.30 a. m. (20th) the wind increased to a gale from the northeast and the barometer fell to 28.74, a change of .95 since 7 a. m. At 12.30 p. m. the barometer read 28.59; at 1.30 p. m., 28.35; at 2.30 p. m., 28.03, and at 2.40 p. m., when shortly after the building was nearly destroyed, the barometer read 28.02, and the velocity of the wind was estimated at over eighty miles per hour. The storm passed away with southeasterly winds. No lives were lost in San Antonio, but property was damaged to the extent of about $60,000.

At 3 p. m., while the storm-centre was over San Antonio, the following observations were made at surrounding stations: Galveston, east of storm-centre, barometer 29.81, or +0.14 inch in eight hours; temperature, 77°; wind, southeast, thirty miles; raining; the maximum in past eight hours being fifty miles. Brownsville, southeast of centre, barometer, 29.69, +0.06 inch in eight hours; temperature, 91°; wind, south, twelve miles; cloudy. Rio Grande City, south of centre, barometer, 29.70, —0.01 inch; temperature, 98°; wind, northwest, six miles; fair. Palestine, northeast of centre, barometer, 29.88, —0.01 inch; temperature, 81°; wind, east, eleven miles; threatening. Abilene, northwest of centre, barometer, 29.86, —0.04 inch; temperature, 82°; wind, east, eighteen miles; cloudy. Fort Davis, west of centre, barometer, 29.80, —0.06 inch; temperature, 85°; wind, north, sixteen miles; cloudy. El Paso, west of centre, barometer, 29.77, —0.07 inch; temperature, 92°; wind, east-northeast, light; clear.

By 10 p. m. of the 20th the barometer had risen 1.06 at San Antonio, wind southeast, brisk, cloudy. At other stations to the eastward the increase in pressure ranged from .05 to .11, while to the westward the fall ranged from .02 to .10, with threatening weather and rain, the greatest change taking place at Abilene, located due northwest of San Antonio, where the wind had shifted to northerly and increased in velocity from eighteen to thirty-seven miles per hour.

By morning of the 21st the barometer had risen decidedly at all stations throughout Texas, the greatest change taking place at Abilene, near the centre of the state, where the rise in the past eight hours was .24. In the next eight hours a decided fall had taken place in west Texas and southeastern New Mexico, the circulation and the increased velocity of the winds, together with the precipitation, indicating the presence of the depression, which by this time was rapidly diminishing in energy. From the afternoon of the 21st to morning of the 22d heavy rains and high winds prevailed in the Panhandle of Texas and eastern New Mexico. The depression now rapidly filled up and entirely disappeared during the 22d. During its passage through Texas the depression was accompanied by violent local storms in the central and northern portions of the state.

The following notes from Signal Service observers and other sources will serve to show the severity of this storm:

Galveston, Texas: the storm which prevailed here during the night of the 19th and morning of the 20th was even more destructive to life and property than the noted storms of 1867 and 1875. The following description of this storm is furnished by the observer at Galveston:

During the 19th the barometer fell quite rapidly but did not get dangerously low, standing at 29.78 at 10 p. m. The lowest noted during the storm was at 7 a. m. of the 20th, 29.67, at which time it began rising and went up even more rapidly than it fell.

On the 19th the wind was from the northeast and east, attaining a storm velocity of twenty-seven miles per hour at 2.10 p. m., then lulling awhile it again set in with renewed violence, attaining a maximum velocity of fifty-three miles from the northeast at 6.40 a. m. of the 20th, after which it decreased very slowly in velocity, the gale ending at 10.45 p. m. On the morning of the 20th the wind backed to east and southeast, continuing brisk until 3 p. m. of the 21st. The weather was fair to cloudy on the 19th, with rain from 10.25 to 11.05 p. m. Rain again began during the night and continued, with varying intervals of cessation, until 10.10 p. m. of the 20th. The wind of the 19th caused the water in the Gulf to become very high, and the cars of the street railroads stopped running about 7 p. m. The water continued to increase in depth, reaching its maximum, four to six feet, at 7 a. m. of the 20th, and remained nearly stationary until 9 a. m., when it rapidly subsided.

The high tide in the Gulf led many to expect an overflow and to prepare for it. Few persons slept that night, and when their fears were realized by the water reaching yards, and then entering houses, the inhabitants set out for places of safety, some in boats and others in hastily constructed rafts. Daylight found the water running in streams across the island from the Gulf of Mexico to Galveston Bay, carrying with it the débris of fences, houses, trees, clothing, furniture, etc. During the storm more than one hundred and sixty houses were more or less damaged, some carried away; a large building used as a skating rink was demolished, loss $5,000; as were also the surf bath-houses, the Mexican Cable Company's building, and a large building called the Pagoda. The Texas-Mexican and street railroad lines were badly damaged; the tracks of the Santa Fé and Missouri Pacific Railroads were washed out at their approaches to the bridge, and on the mainland several miles of track were washed out or otherwise badly damaged. No telegraph connection could be made until late in the afternoon of the 20th. Many of the telephone wires in the city were broken, and the lines of the fire-alarm system disordered. The schooner "Livonia Perkins," forty tons, engaged in the lumber trade, was capsized at 9 p. m. of the 19th and two men were drowned. The schooner "S. W. Perry" was wrecked and two men drowned. The schooner "Ella Elliott" was stranded and wrecked, loss $30,000, besides cargo of ice. Numerous other smaller vessels and yachts were capsized and otherwise damaged. The entire loss of property is estimated at $150,000. No trains arrived or left the city from the night of the 19th until 9 p. m. of the 21st.

Indianola, Texas: during the afternoon of the 19th the weather was threatening and the wind strong from the northeast; at 8 p. m. the wind moderated somewhat, but soon rose again, becoming strong enough at 9 p. m. to cause some alarm. From that time the force of the wind gradually increased, veering slightly, and about daylight the water in the bay commenced to rise rapidly; at this time the wind was blowing at the rate of seventy-two miles per hour and the Signal Office building gave way; in attempting to escape, the observer, I. A. Reed, was killed by falling timber. A lamp in the office set fire to the building and, although rain was falling heavily, it was burned, and also more than a block of buildings on both sides of the street. Shortly after daylight the wind grew stronger, blowing from the east; about 5 a. m. of the 20th most of the damage to property was done. Houses were falling and floating from their foundations, and the people were crowded together in such places as were considered most secure, unable to do anything to save their property. More than

twenty lives were lost at Indianola, and it is believed that the number would have been much larger but for the fact that the worst of the storm did not come until after daylight. About 11 a. m. the wind had moderated perceptibly and by night was only a light south breeze. The water receded very slowly, however, and it was not until the afternoon of the 22d that the main street was free from water. The appearance of the town after the storm was one of universal wreck. Not a house remained uninjured, and most of those that were left standing were in an unsafe condition. Many were washed away completely and scattered over the plains back of the town; others were lifted from their foundations and moved bodily over considerable distances. Nearly three miles of the Gulf, Western Texas, and Pacific railroad track were torn up and scattered on the prairie. Over all this strip of low ground, as far as could be seen, were the wrecks of houses, carriages, personal property of all kinds, and a great many dead animals. Very few people were able to save anything whatever, and as the houses which were left were scarcely habitable the town was deserted as fast as possible.

San Antonio, Texas: the morning of the 20th opened with light rain and brisk northeasterly winds. Light rain continued until 9 a. m., when high northerly wind and heavy rain set in; the wind gradually increased in force until shortly after 11 p. m. it had attained the velocity of a gale, unroofing several buildings, including the signal station; with the latter roof, the anemometer and wind vane were carried away. The wind attained its highest velocity at 2 p. m.; estimated velocity eighty miles per hour. Much damage was done in this town and vicinity by the violence of the wind; the quartermaster's corral was completely demolished, and a considerable quantity of grain and hay destroyed. All telegraph and telephone communication was cut off. Small hail-stones fell from 2 to 2.15 p. m.; amount of rainfall 4.40 inches. After the centre of the storm had passed the wind backed to northeast, east, and southeast, where it remained stationary during the afternoon and evening.

Corpus Christi, Texas: a hurricane passed over this place on the night of the 19–20th, doing much damage to property. Four buildings, including a church, were destroyed, and telegraph communication was completely cut off. At Luling the storm commenced about daylight, and was accompanied by unusually heavy rain. Several houses were destroyed, numerous trees were blown down, and cotton was stripped from the stalk and blown over the fields. At Beeville many houses in course of construction were demolished, and numerous other buildings unroofed or otherwise injured.

Abilene, Texas: the morning of the 20th opened with cloudy weather and gentle wind from the south; during the day the wind increased in force, attaining at night a velocity of thirty-three miles per hour, and backing to the northeast. Rain began falling at 7.20 p. m. During the early morning of the 21st the wind veered from northeast to southeast and continued blowing a gale, reaching a maximum velocity of forty-eight miles per hour about 4 a. m., after which it began to subside, at the same time veering toward the southwest. Only slight damage was done by the storm.

Seguin, Guadalupe county, Texas: at 6.30 a. m. of the 20th rain began falling, with light wind from the north. At 8 a. m. the wind began to increase in force, shifting to the northeast at 10 a. m., and continuing to increase in velocity until, from 11 a. m. to 1 p. m., it blew at the estimated rate of eighty-five miles per hour. A number of buildings and trees were blown down and numerous dwellings unroofed. Moderate rain fell during the storm, but no thunder or lightning occurred.

Houston, Texas: the storm of the 19th and 20th began here about 7 p. m. of the 19th and continued to increase in violence during the night. Rain began falling at 11 p. m. At 9 p. m. the wind reached its greatest velocity, breaking numerous trees, but doing no damage to buildings. The water in Buffalo Bayou was higher than ever known before, being forced up by the high water of the Gulf.

Victoria, Victoria county, Texas: a very severe storm prevailed here at 5 a. m. of the 20th. The wind blew with hurricane force, and much property was destroyed. Forty buildings, including six churches, were completely destroyed. The estimated value of the property destroyed in the town and county is $100,000.

Cuero, De Witt county, Texas: a severe storm of wind and rain prevailed here between 5 and 11.30 a. m. of the 20th. Numerous buildings were wrecked and property of all kinds damaged.

IX.—This depression first appeared in the Saskatchewan Valley at midnight of the 20th, and during the following day moved southeastward into Minnesota, attended by violent local storms in the latter state and southeast Dakota, with heavy rains and thunder-storms in the southern portion of Wisconsin. During the 22d the depression moved southeastward to the lower lakes, where it gradually dissipated by the afternoon of the following day. While the area was central in southern Michigan on the afternoon of the 22d violent local storms occurred in northern Indiana and western Ohio. The final disappearance of the depression in western New York may have been influenced by the presence of low-pressure area number x, which on the morning of the 23d had just reached the southwest coast of Nova Scotia.

The following notes relative to this area of low pressure are from the reports of Signal Service observers:

Saint Paul, Minnesota: during the 21st light to fresh winds prevailed until 6.48 p. m., when the wind veered to west and suddenly increased in force to a gale of twenty-five miles an hour. From 7.00 to 7.40 p. m. a maximum velocity of west thirty-one miles was attained, during which time several chimneys, signs, and windows were blown down.

La Crosse, Wisconsin: three light thunder-storms occurred at intervals between 5.40 a. m. and 2.25 p. m. on the 21st. Very heavy rain and severe thunder-storm set in at 8.50 p. m.; the storm passed from northwest to southeast. At 9.05 p. m. a gale of thirty-six miles per hour set in from the southeast. No serious damage was done by wind at this place. All telegraph lines between here and Saint Paul were down, and several persons were drowned by boats capsizing on Lakes Minnetonka, Pepsin, and Cedar.

Delavan, Walworth county, Wisconsin: at 3 p. m. of the 21st heavy clouds gathered in the west and the wind began to blow briskly from the southwest; at 4.10 p. m. the wind changed to northwest and blew with the violence of a gale. At this time the thermometer registered 87°, at 4.40 p. m. 72°, dropping 15° in half an hour. Light rain and heavy thunder-storm set in at 5.50 p. m., and at 6 p. m. the wind was perfectly calm. At 6.05 p. m. a gale suddenly set in from the northwest, blowing in gusts, with an interval of a few seconds between; this high wind continued only five minutes, but blew down a large tobacco warehouse, broke off growing corn, and destroyed hundreds of shade trees. During the storm a barn was struck by lightning and burned. At 8.35 p. m. hail began falling; the stones were small, doing no damage.

X.—This depression is an ocean storm whose presence was first felt by the New England coast stations at midnight of the 22d. The parabolic curve of its path brought the depression southeast of Yarmouth, Nova Scotia, on the morning of the 23d, the barometer at that station having fallen .33 in the past eight hours, with heavy rain, and wind shifting to northerly. During the day the depression disappeared over the ocean.

XI.—The barometer fell quite rapidly during the afternoon of the 23d in eastern Montana, and on the following day in northwestern Dakota and Manitoba. The winds were southerly and brisk to high, with the temperature ranging from 96° to 102° on the afternoon of the 24th in Dakota, Minnesota, and Manitoba. No rain accompanied the area throughout its course, which was probably cut short in its easterly movement by the advance of low-pressure area number xii.

XII.—By the morning of the 25th this depression became well established in northeastern Montana, but no rain fell until the afternoon, when the area was then central in the extreme northern portion of Dakota. During the remainder of its course this depression passed eastward too far north to make it possible for Signal Service stations to observe any important changes in its progress.

XIII.—This depression suddenly appeared to the north of the mouth of the Saint Lawrence, and during the day passed southeastward over the Gulf, attended by threatening weather and occasional light rains.

XIV.—Since midnight of the 25th the barometer had been slowly falling in eastern Colorado and western Kansas, but the weather remained clear or fair throughout those states, Indian Territory, and Nebraska. By midnight of the 27th rain had fallen throughout Colorado and western Nebraska, with the area central in northwestern Kansas. During the 28th it moved northeastward throughout southern Iowa, northern Illinois, and southern Wisconsin, accompanied by occasional heavy rains and thunder-storms. On the morning of the 29th the depression became much enlongated, the major axis extending from Lake Superior southwestward to Texas, throughout which region occasional heavy rains and thunder-storms occurred during the day. By midnight the trough had widened considerably, while moving to the eastward, and now embraced the central Mississippi valley and the Lakes; rain and occasional thunder-storms prevailed throughout this region. The spread of this trough from the Lakes to the Gulf remained intact up to midnight of the 30th, with rain throughout the east Gulf, south Atlantic, and middle Atlantic states, and the lower lake region. The heaviest rains of the month in Virginia, Pennsylvania, and New York occurred during the passage of this area on the 30th. During the 31st the area passed eastward just north of the Saint Lawrence, with rain throughout New England and the Canadian Maritime Provinces, followed by winds shifting to northwesterly and clearing weather.

NORTH ATLANTIC STORMS DURING AUGUST, 1886.

[*Pressure in inches and millimetres; wind-force by Beaufort scale.*]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to September 20, 1886.

Twelve depressions are traced, of which seven, numbers 2, 3, 4, 7, 8, 10, and 12, are continuations of storms which first appeared over the North American continent; number 1 is a continuation of ocean depression number 12 charted for July, 1886; numbers 5 and 6 first appeared in the vicinity of the Windward Islands, and are traced over the Caribbean Sea and Cuba; and numbers 9 and 11 are first charted over the ocean west of the seventieth meridian. Three depressions, numbers 2, 3, and 4, are traced across the ocean from coast to coast.

The following presents the characteristics of the depressions traced for the present month, as compared with those traced over the north Atlantic for August, 1885:

In August, 1885, seven storm-areas appeared over the ocean, four of which displayed considerable energy; one apparently originated within the sub-tropical region, between latitude 25° and 30° N., and one was a continuation of a West Indian hurricane which caused many disasters along the coast of the Carolinas during the last decade of the month.

In August, 1886, the cyclonic depressions which passed over the north Atlantic Ocean and the West India islands were exceptionally destructive, and reports indicate that the gales or hurricanes accompanying their passage were the severest experienced during corresponding months in many years. The abnormal energy displayed by the depressions may be attributed to the unusual warmth of the water in the north Atlantic Ocean which caused large evaporation, and the great humidity of the atmosphere was conducive to the development of violent features attending the cyclonic circles.

The month opened with an area of low pressure west of the British Isles, causing fresh gales between the twentieth and thirtieth meridians. Generally unsettled and stormy weather prevailed north of the forty-fifth parallel until the 4th, when it commenced to clear west of the fortieth meridian, the settled condition extending eastward to the the European coast during the next four days. On the 9th the pressure was low west of Ireland, in W. 21°, and southeast of Newfoundland; from this date until the 15th the weather over the ocean was generally unsettled, with frequent gales and rain. From the 13th to the 23d the passage of hurricanes through the Caribbean Sea caused severe disturbances over the West India Islands and adjoining waters. From the 15th to 20th the weather was comparatively settled over the north Atlantic Ocean, while during the balance of the month severe storms were frequent, more especially over the western portions.

The following are brief descriptions of the depressions traced:

1.—This was a continuation of ocean depression number 12 traced for July, 1886, and is taken up on the 1st in N. 52°, W. 19°. During this date it moved north of east and was central on the 2d north of Ireland, after which it disappeared to the northeastward. This storm apparently possessed small energy, and special reports relative to its passage have not been rendered.

2.—This storm was a continuation of land depression number i, and passed northeast over the southern portion of Newfoundland during the 3d, with pressure ranging to about 29.20 (741.7). On the morning of the 4th the depression was central in N. 51°, W. 46°; continuing a north of east course it is traced to N. 57°, W. 26° by the 6th, during which date it passed beyond the region of observation. During the 2d, 3d, and 4th this depression possessed great energy and dominated the weather conditions over a large extent of the western ocean; accompanying its passage into high latitudes, a marked increase of pressure and loss of strength were shown.

The following special reports were received from vessels which came within the influence of this depression; the reports indicating that, in instances, subsidiary disturbances attending the general storm were encountered:

The s. s. "Horn Head," Capt. M. R. Thompson, commanding, encountered a gale, force 8, during the 1st and 2d; lowest barometer, 29.68 (753.9), at 6 p. m. of the 2d, when in N. 36° 41′, W. 68° 27′. Wind set in from ssw., changed to sw., w., and wnw. during the storm, these changes being gradual from 4 p. m. to 9 p. m. of the 2d, and to nw., n., and nne. following the passage of the disturbance. For several days previous the wind had been south and the weather very warm and moist, with high, steady barometer. The captain further states that this disturbance was remarkable for the very great amount of electricity displayed and the tremendous downpour of rain which took place from 3 p. m. to 9 p. m. of the 2d.

Chief Officer A. O. Welch, of the s. s. "Easington," Capt. D. Morgan, commanding, reports: "August 2d, in N. 43° 6′, W. 51° 50′, a moderate gale began at night from sw., veering to w., and on the 3d to s. by w., and increased to fresh gale, with terrific squalls and high seas; veered to w. in p. m., and continued until 4 p. m. of 4th, then moderated and veered to nw. Lowest barometer, 29.41 (747.0), at noon on 3d, when in N. 42° 46′, W. 55° 42′."

Capt. M. P. Lund, commanding the s. s. "Durham City," reports: "August 2d, 8 p. m., in N. 45° 32′, W. 54° 20′, a strong gale began from sw., with heavy rain; gale continued through the 3d in N. 43° 36′, W. 58° 54′, veering to nw. in p. m., and increasing to a whole gale, with hard squalls; ship rolled heavily and shipped seas; gale continued until early a. m. of 4th, then moderated. Lowest barometer, 29.29 (744.0), at 4 a. m. of the 3d, when in N. 43° 36′, W. 58° 54′."

The s. s. "Island," Capt. W. Skjodt, commanding, on the 2d, in N. 43°, W. 52° 45′, had a fresh se. gale, with heavy rain and falling barometer; at 8 a. m. of the 3d the barometer read 29.53 (750.0); wind then changed to w. and moderated, with clearing weather; then changed to sw. and freshened; at 9 p. m. the wind changed suddenly to w. in a squall, blowing a high gale, with a very heavy sea.

The s. s. "Ocean Prince," Captain Milburn, commanding, on the 3d, in N. 43° 10′, W. 45° 55′ (at noon), had wind increasing to a whole gale, sw., at 3 p. m., with a very heavy sea from ssw. and another not quite so heavy from w., between which the ship labored heavily and shipped large quantities of water; lowest barometer, 27.71 (754.6), at 7 p. m.

The s. s. "City of Chicago," Capt. F. Watkins, commanding, experienced a fresh gale, force 8, during the 3d and 4th; lowest barometer, 29.23 (742.4), at 4 a. m. of the 3d, when in N. 45° 40′, W. 53° 30′; wind set in from sse., veering to s., ssw., sw., and wsw. during, and to w. following, the storm. The wind was strongest from wsw., and a fresh gale continued for eighteen hours, with clear, pleasant weather.

The s. s. "State of Alabama," Captain Gandy, commanding, had a fresh gale during the 3d and 4th; lowest barometer, 29.21 (741.9), at 4 a. m. of the 3d, when in N. 42° 59′, W. 56° 43′; gale set in from s., veering to sw., w., and wnw., during, and continuing westerly following, the storm. The s. s. "Werra," Capt. R. Bussius, commanding, had a strong gale on the 3d and 4th; lowest barometer, 29.36 (745.7), at 4 a. m. of the 3d, when in N. 42° 34′, W. 59° 42′; wind set in from wsw. and veered to w. and wnw. The s. s. "Ripon City," Capt. John Jenkins, commanding, had a fresh gale on the 4th and 5th; lowest barometer, 29.40 (746.7), at noon of the 4th, when in N. 48° 36′, W. 49° 16′; gale set in from sw., veering to w. and wnw.

The s. s. "Wetherby," on the 6th, in N. 56° 11′, W. 21° 40′

(at noon), had a moderate gale, w., beginning at 4 p. m.; at 8 p. m., heavy squalls and high seas; wind veered to nw. in a. m. of the 7th, in N. 54° 59′, W. 25° 17′ (at noon), and a moderate gale, nw., continued until midnight. Chief Officer Milne, of the s. s. "Grafton," Capt. J. Seaborne, commanding, reports a strong gale on the 7th; position at noon, N. 51° 13′, W. 26° 8′. At 1 a. m. gale began from w., with heavy squalls, rain, and high seas, and moderated in p. m.; barometer ranged from 29.96 (761.0) at midnight of the 6th to 30.00 (762.0) at noon of the 7th.

3.—This storm was a continuation of land depression number ii, and passed eastward off the coast in about N. 37° during the 7th. Following a generally north of east course this depression is traced across the ocean, being central over Ireland on the 13th. The storm gathered strength during its passage, exhibiting very low pressure, about 29.00 (736.6), on the 11th, when central in N. 51°, W. 34°, after which date it commenced to fill up, although very violent disturbances continued to attend its eastward movement.

The following reports were made relative to this depression:

The schooner "Cephas Starrett," on the 7th, off Barnegat, had a heavy ne. gale with heavy seas, lasting eight hours, in which vessel labored heavily, causing her to spring a leak and put back for repairs. The s. s. "Wetherby," 10th, in N. 50° 30′, W. 37° 25′, at 8 p. m., had a fresh breeze, ssw.; 9 p. m., wind suddenly veered to n., blowing strong gale and continuing with terrific squalls and high seas; 11th, in N. 48° 33′, W. 41° 40′, wind backed to nw. at noon, and moderated; lowest barometer, 29.28 (743.7), from 8 p. m. to midnight of 10th. Capt. H. McKay, commanding the s. s. "Servia," reports having encountered a gale on the 9th and 10th, commencing from the se. on the 10th, when in N. 50° 22′, W. 30° 58′, and ending during the evening of the 11th in N. 48° 31′, W. 40° 12′; wind shifted to w. and nw.; lowest barometer, 29.00 (736.6), from 4 to 7 a. m. of the 11th. Capt. A. McKay, commanding the s. s. "Catalonia," reports: "10th, in N. 46° 28′, W. 42° 09′ (at noon), at 8 p. m. experienced the first of a westerly gale, wind west, force 6, barometer 29.98 (761.5), and falling slowly; midnight, barometer 29.90 (759.4), wind west, force 8, sea rising fast, and every indication of a high gale. 11th, 8 a. m., barometer 29.90 (759.4), wind and sea increasing; noon, wind w., force 10, barometer 29.90 (759.4), hard squalls and very high west sea; 6 p. m., barometer rising, and indications of gale moderating; midnight, wind west, force 8, with hard squalls, high sea, and rising barometer. Gale ended at noon of 12th, with wind w."

The s. s. "Wisconsin," Captain Bentley, commanding, on the 11th, in N. 50° 13′, W. 31° 29′, had heavy gale to hurricane, veering from s. to nw. The s. s. "Ems," Capt. T. Jungst, commanding, on the 11th, in N. 49° 34, W. 23° 48′, had gale from s., force 5 to 6, with rain, commencing at 6.35 a. m.; 12.56 p. m., in N. 49° 21′, W. 26° 36′, wind suddenly shifted to w., force 7, weather clearing; 7.56 p. m., in N. 49° 11′, W. 28° 59′, wind had increased to whole gale with heavy squalls and a fearful sea, wind nw., barometer 29.41 (747.0); wind moderated at night from nnw.; high swell from ne. and ene. on the 12th. The bark "Western Chief," Capt. F. Sander, commanding, on the 11th, in N. 48° 10′, W. 35° 23′ (at noon), had a strong gale, nw., with very violent squalls and high, cross seas; barometer fell to 29.43 (747.5).

The s. s. "Grafton," on the 10th, in N. 49° 55′, W. 40° 26′ (at noon), had fresh se. breeze and heavy rain beginning at 4 p. m.; at 6 p. m., suddenly veered to n. and blew strong gale with high seas, and continued, backing to nw. in a. m. of the 11th, in N. 48° 6′, W. 45° 0′, and moderated at 4 a. m.; lowest barometer, 29.66 (753.4), at midnight of the 10th. The s. s. "England," Capt. T. P. Heeley, commanding, had a fresh gale, s. veering to nw., on the 10th and 11th; lowest barometer, 29.40 (746.7), at midnight of the 10th, in N. 48° 35′, W. 38° 10′. The s. s. "Ethiopia," Captain Wilson, commanding, had a whole gale, force 10, on the 10th and 11th; wind set in from se. and veered to nw.; lowest barometer, 29.16 (740.7), at midnight of the 10th, in N. 50° 58′, W. 37° 45′. Chief Officer Davis, of the s. s. "Virginian," Capt. M. Fitt, commanding, reports having encountered a fresh to strong gale with hard squalls and rain on the 11th, in N. 47° 22′, W. 36° 26′ (at noon); wind veered from sw. to nw. and backed to w.; lowest barometer, 29.51 (749.5), at 9.44 a. m.

The s. s. "State of Pennsylvania," Capt. A. J. A. Mann, commanding, had a gale from se., backing to nw. on the 11th and 12th; lowest barometer, 28.99 (736.3), at 4.15 p. m. of the 11th, when in N. 53° 0′, W. 33° 20′. Capt. E. Bently, commanding the s. s. "Wisconsin," reports: "Had a hurricane on the 11th, in N. 50° 13′, W. 31° 29′ (at noon). At midnight of the 10th, barometer, 29.95 (760.7); at 4 a. m. of 11th, 29.59 (751.6), wind se.; 8 a. m., 29.09 (738.9), wind sw.; noon, barometer 28.89 (733.8), wind wsw.; 2 p. m., 29.04 (737.6), wind wnw.; at this hour the wind blew with hurricane violence until 4 p. m.; at 6 p. m. the wind changed to nnw., and at midnight the barometer had risen to 29.59 (751.6), with a strong gale blowing; had to keep ship's head to the sea." The s. s. "Pavonia," Capt. Bentley Woolfenden, commanding, experienced a strong gale on the 11th and 12th; wind veered from s. to w.; lowest barometer, 29.26 (743.2), at 1 a. m. of the 12th, in N. 51° 15′, W. 15° 46′. The gale was accompanied by rain, hard squalls, and high seas.

Capt. Wm. Tyson, commanding the s. s. "Holland," reports: "A gale commenced at daylight on the 11th from sw.; barometer falling very fast; at 4 p. m., in N. 49° 40′, W. 27° 53′, barometer at its lowest, 29.08 (738.6); wind then veered to wnw., and increased in violence till midnight, when it blew a very heavy gale, with squalls of exceptional severity for the time of year, accompanied by a dangerous, confused, cross sea. By noon of the 12th the gale had moderated and was followed by fresh nw. winds." Chief Officer Stembridge, of the s. s. "Norseman," Capt. E. Maddox, commanding, reports: "August 11th, in N. 50° 25′, W. 28° 37′ (at noon); 8 a. m., strong breeze, s., with rain-squalls; 10 a. m., veered to sw., increasing to fresh gale, with heavy squalls, then veered to w., blowing strong gale, continuing till 6 a. m. on the 12th in N. 49° 54′, W. 32° 19′ (at noon); barometer 29.34 (745.2) at noon of the 11th."

The s. s. "Leerdam," Capt. P. Slierendregt, commanding, had a heavy gale on the 11th and 12th; wind veered from ssw. to nw.; lowest barometer, 28.94 (735.1), at 3.05 a. m. of the 12th in N. 49° 50′, W. 23° 30′. The bark "Orion," Capt. A. Mathiesen, commanding, on the 11th, in N. 47° 18′, W. 29° 4′ (at noon), had a gale, w., commencing at 5 a. m.; barometer continued falling until 10 p. m., with gale increasing; 6 to 9 p. m., gale from wnw., with rapidly increasing sea; gale continued all night, decreasing and backing to westerly at 8 a. m. of the 12th. Capt. H. E. Nickels, commanding, the s. s. "Noordland," reports having encountered a whole gale on the 11th and 12th. Gale set in from se., veering to westerly; lowest barometer, 29.01 (736.8), at 9.50 a. m. of the 11th when in N. 50° 34′, W. 27° 38′.

The s. s. "Pietre de Connick," Capt. E. Smit, commanding, experienced a strong gale on the 12th and 13th. Wind set in from ssw. and veered to nw., with heavy seas and hard squalls until 2 a. m. of the 13th; lowest barometer, 29.71 (754.6), at 12 noon of the 12th, in N. 49° 16′, W. 26° 45′. The s. s. "Marengo," Captain Abbott, commanding, had a strong gale with high seas, heavy squalls, and rain on the 12th and 13th. Wind set in from s. and veered to westerly; lowest barometer, 29.31 (744.5), at noon of the 12th, in N. 49° 30′, W. 18° 44′. The s. s. "Camellia," Captain Buck, commanding, on the 11th had a heavy gale from ssw. to nnw., lasting from noon to 6 p. m. of the 12th; ship's position N. 50° 16′, W. 24° 5′, to N. 50° 30′, W. 24° 30′; barometer 29.10 (739.1). Captain Manley, commanding the s. s. "Borderer," reports: "During the p. m. of the 13th, at the entrance of the English Channel, it blew a moderate gale from the sw., attended with very heavy rain, some of the showers being almost a sheet of water; at 7 p. m. the wind shifted to nw. and the sky cleared."

4.—This storm was a continuation of land depression num-

ber iv, and passed eastward over the Gulf of Saint Lawrence and Newfoundland during the 12th. Following a generally north of east course the depression is traced across the ocean to the west coast of Scotland, where it passed beyond the region of observation during the 16th. This storm advanced very rapidly, and was attended by violent disturbances. The barometric pressure decreased as the low area moved eastward, and readings ranging below 29.30 (744.2) were recorded on the 15th.

The following special reports relative to this storm are at hand:

The s. s. "British Princess," Capt. E. H. Freeth, commanding, on the 14th, in N. 51°, W. 24° 43′, had a gale from ssw., suddenly increasing from force 5 to force 10, with very high sea; barometer 29.53 (750.0); wind went to wnw. The s. s. "Leerdam," Capt. P. Slierendregt, commanding, on the 14th and 15th, had a whole gale, westerly; lowest barometer, 29.60 (751.8), at 6 p. m. of the 14th, in N. 49° 40′, W. 36° 5′. The s. s. "Pavonia," Capt. Bentley Woolfenden, commanding, on the 14th and 15th, had a strong gale with heavy rain and high westerly sea; wind veered from sw. to nw.; lowest barometer, 29.62 (752.3), at 7 a. m. of the 15th, in N. 50° 19′, W. 29° 34′. The s. s. "Canadian," Capt. John Kerr, commanding, on the 15th and 16th, had a strong gale, westerly; lowest barometer, 29.55 (750.6), at 12 noon of the 15th, in N. 52° 23′, W. 20° 20′. The s. s. "State of Georgia," Capt. G. Moodie, commanding, on the 15th and 16th, had a strong to whole gale, ssw., veering to nw. and backing to sw., blowing heaviest from nw. on the 16th; lowest barometer, 29.33 (745.0), at 6 p. m. of the 15th, in N. 55° 23′, W. 11° 44′.

The s. s. "Britannic," Capt. H. Perry, commanding, on the 15th, in N. 51° 18′, W. 23° 56′, had moderate to strong westerly gale and high sea. The s. s. "City of Richmond," Capt. A. W. Lewis, commanding, on the 15th, in N. 49° 40′, W. 35° 48′, had a strong gale, w. to nw., with heavy head sea. The s. s. "Eider," Capt. H. Helmers, commanding, on the 15th, in N. 48° 29′, W. 25° 52′, had a fresh gale, sw. to nw., with high head sea. The s. s. "La Bretague," Capt. M. de Jousselin, commanding, on the 15th and 16th, had a moderate gale, ssw., veering to nw.; lowest barometer, 29.84 (758.0), at 1 p. m. of 15th, in N. 50° 15′, W. 12° 0′. The s. s. "Borderer," Capt. Fred Manley, commanding, on the 15th and 16th, in N. 49° 10′, W. 26° 19′ (at midnight of 15th), had a strong gale, westerly; gale strongest at about 1.30 a. m. of 16th, when ship pitched violently and shipped quantities of water.

5.—This was a tropical cyclone and first appeared on the 13th over the western portion of the Caribbean Sea, from whence it moved north of west into the Gulf of Mexico by the 18th, passing over the Island of Cuba during the 17th.

The following special reports indicate the violent and destructive character of this storm:

Capt. Robert B. Kelly, commanding the s. s. "Ozama," makes the following report: "On the night of August 14th a hurricane passed San Domingo City, accompanied by heavy rain; barometer fell to 29.53 (750.0) at 2 a. m. of the 15th, after which the weather cleared, with rising barometer; wind set in from the n., changing to nw., w., and sw., and to se. following the passage of the disturbance." The schooner "Gertie M. Rickerson," in N. 17° 40′, W. 67° 30′, on the 14th, encountered a hurricane from ese. to sw., lasting six hours.

Capt. Frank Stevens, commanding the s. s. "Manhattan," reports: "August 17th, passed Alligator Reef at 4.02 p. m. bound to Havana; wind blowing strong from ene., with heavy squalls of rain and low scud flying very rapidly to the westward. A heavy, low, black, solid bank of clouds from ene. to ese., from which all the squalls and scud came, seemed to indicate that the storm-centre was there, which would put me on the lee shore, so I ran to the southwest as long as possible to get clear of the Florida reefs, and then hove-to on the starboard tack with head to the eastward. I ran until 1.52 a. m. of the 18th, when could run no longer, as the wind had increased so, and sea so high and dangerous, with barometer down to 29.36 (745.7) and falling, that I hove-to, head to the eastward; wind from e. by s. and ese., and off e. by n., blowing very hard for four hours, reaching at times seventy-five or eighty miles per hour, with a very high dangerous sea. At 4.22 a. m. the barometer commenced to rise; squalls not so frequent; sea not so high. At 9.22 a. m. kept off on our course to Havana, and noticed the heavy bank of clouds true wnw. from ne. and around to n., moving slowly in a nnw. or northerly direction; had fresh southerly winds balance of passage."

Capt. W. F. Bacon, of the barkentine "Harriett S. Jackson," at Cardenas, Cuba, on the 17th, reports as follows: "There was at this place a revolving storm beginning early in the morning, reaching its greatest force (about sixty miles) at 3 p. m., after which it moderated to a strong breeze. The gale began from ne. and backed to w. and s., blowing the hardest from nw. through to the sw. quadrant. This storm was preceded, and has been followed by, heavy northeast trades, accompanied by terrific squalls, with and without rain."

The observer at Key West, Florida, reports: "17th, day opened threatening, with brisk ne. winds; 7 a. m., barometer 29.93 (760.2), falling to 29.72 (754.9) at 3 p. m.; 12.15 p. m., squall from ne. of forty-eight miles per hour; wind continued ne. during the day, blowing in heavy gusts or squalls, and showing a tendency to back; 8 p m., the wind hauled gradually to e., which indicated that the storm was approaching the station, and caused much apprehension; barometer continued nearly stationary at 29.68 (753.0) from 5.30 p. m. until past midnight, with numerous heavy gusts of wind, estimated at sixty miles per hour. 18th, barometer commenced to rise rapidly in the early morning, standing 29.82 (757.4) at 7 a. m.; wind slowly hauled to se., blowing in very heavy squalls; wind dropped below a gale velocity at 9.15 a. m.; weather brightening."

The s. s. "Comal," on 17th, in N. 29° 41′, W. 77° 36′, wind backed to ese. and se., with heavy rain squalls and easterly swell. 18th, in N. 26° 35′, W. 80° 3′, brisk se. wind and clear weather. The U. S. Light-house Tender "Arbutus," at Tortugas on the 17th and 18th, was in the direct track of the cyclone which passed over that position between 12 midnight and 2 a m. of the 18th, during which time the wind attained a velocity of about seventy miles per hour. The damage caused by the cyclone in Cuba during the 17th and 18th was quite severe. The storm-centre entered Cuba near Manzanilla, crossed the island, and left it near Sagua.

6.—This was a cyclone of tropical origin, and was first reported to the eastward of the Barbadoes, under date of the 15th. Passing westward through the Caribbean Sea to about N. 14°, W. 76° by noon (Greenwich mean time) of the 19th the storm-area circled to the northwest and passed north over Cuba, in about W. 81°, during the 22d; it then moved northeastward aloug the track of the Gulf Stream, and united with depression number 12 northeast of Newfoundland on the 28th. This storm was particularly severe, causing loss of life, and destroying crops and property of immense aggregate value.

The following reports illustrate its general character:

Captain Locke, of the s. s. "Muriel," from the Barbadoes, states that a severe cyclone was experienced at Saint Vincent on the 16th, doing much damage; estimated width twenty to thirty miles. It passed over the island from northeast to sw., the whole of the southern part of the island being laid waste. A number of people were killed and many injured. A steamship from Europe reported a hurricane, lasting eight hours, on the night of the 15th, ninety miles northeast of the Barbadoes.

The bark "Kestrel," in N. 12° 40′, W. 69° 30′, had a heavy gale, lasting four hours, during which sails were lost and split, cabin windows stove in, and cabin flooded; lowest barometer 28.90 (734.0). On the 17th a heavy gale from the west, veering to southeast, passed over Curacoa, causing much damage on the island.

Capt. T. M. MacKnight, commanding the s. s. "Claribel," makes the following report: "Laying in Morant Bay, inside reefs, August 19th, 8 a. m.; barometer 29.76 (755.9), and gradu-

ally falling. Several indications of a hurricane were absent until 11 p. m., when barometer was 29.48 (748.8), and falling; made all preparations for standing to sea, when the wind shifted from 11 p. m. of 19th to 1.50 a. m. of 20th, and increased, blowing a terrific hurricane as the centre passed to the southward; barometer at 1.30 a. m., 28.86 (733.0); 2.30 a. m., barometer 29.16 (740.7), with wind hauling rapidly to se.; 3.30 a. m., barometer 29.36 (745.7), with tremendous sea running dead on to the land. Having swung clear of the reef, with seas breaking all around the ship, weighed both anchors at once and steamed out full speed, with wind force 11; at 4.30 a. m. was well clear of broken water and stood to southward until 9 a. m., when barometer stood 29.66 (753.4), then bore away for Kingston. The red sunsets and sunrise were absent previous to this storm, as also were the feathery cirrus until the very last. The nimbus clouds were well defined and the scud flew in true horizontal lines; the cirro-stratus clouds converged at one time to the centre, but were lost as the centre approached. I calculate that the centre must have passed one hundred and twenty miles from our position, and I think the storm was one of large diameter. During the height of the storm I had two anchors down, and, steaming at full speed, did not drive at all. At commencement of storm wind set in from ne., changing to ene., e., se., and s. Lowest barometer, 28.86 (733.0), at 1.50 a. m. of the 20th; force of gale, at its height, over 12."

Captain Shackford, commanding the s. s. "Newport," reports: "Experienced a storm of unusual severity on the 19th, soon after leaving the island of Navassa. During the afternoon the sea grew rough and rain fell in torrents, while a strong wind from the northeast increased to a gale. About 6 p. m. the steamer rolled and pitched at a fearful rate. At 8 p. m. the barometer continued to fall and the vessel was headed to the eastward, away from the vortex of the storm, which by that hour had developed all the symptoms of a well-defined cyclone. The wind had increased to a hurricane and the seas were fearful. Before morning the storm-centre had passed to the westward and northward, and the ship again laid her course for Colon."

The s. s. "Alvo," Captain Williams, commanding, August 19th and 20th, at Navassa, had a heavy blow from sw. The s. s. "City of Para," Capt. Frederick Henderson, commanding, experienced a strong gale, force 9, commencing in a. m. of the 19th, and continuing until the p. m. of the 20th; wind set in from ne., backing to nw., w., sw., s., se., ese., during, and continuing easterly after the passage of the depression; lowest barometer, 29.40 (746.7), at 1.30 p. m. of the 19th, when in N. 15° 36′, W. 75° 52′. A heavy ne. swell continued from the 19th to 23d. Advices from Jamaica state that during the hurricane of the 19th the entire pimento crop was blown off the trees, nearly all the coffee crop for this year destroyed, several parishes of the island denuded of trees, banana plantations destroyed, and ships in the harbor of Kingston damaged.

The s. s. "Ailsa," Capt. J. W. Sansom, commanding, had a whole gale to hurricane on the 19th and 20th; from ene. veering to sse.; lowest barometer, 29.48 (748.8), at 4 a. m. of the 20th, in N. 18° 35′, W. 76° 20′. On the 23d, in N. 25° 0′, W. 74° 0′, had a fresh gale from se., with very confused sea; barometer oscillated between 29.72 (754.9) and 29.80 (756.9) in the space of fifteen minutes; heavy mass of clouds to the westward, and scud flying from s.; had every appearance of a hurricane to the westward travelling to northward.

August 20th a cyclone passed near Montego Bay, Jamaica. Wind set in from ene., with rain-squalls, shifting to nne., n., nw., and wsw.; lowest barometer, 29.61 (752.1), at 10 a. m.; greatest wind force from nw. from 9.30 to 10.30 a. m. On the 17th the lower clouds were moving to a cyclone north of Santiago; the upper were moving to the cyclone coming. On the 18th the cirrus from n. or ne. indicated a disturbance. This cyclone caused much injury to property and crops on the island.

A hurricane swept over the island of New Providence on the night of the 22d. The gale was from the southeast and blew with great violence for several hours. A number of houses were blown down and many damaged. Sailing vessels dragged their anchors and went ashore or were driven over the bar and out to sea. Reports from the Berry Islands and Andros state that the storm there was very heavy, and that many sponging and fishing vessels were wrecked. Some loss of life is also reported.

The bark "Flash Light," Captain Dexter, commanding, on the 24th, in N. 34°, W. 74°, had a hurricane from se., veering to w., blowing with terrific fury; considerable damage caused to vessel. On the same date the schooner "Gertie M. Rickerson," Captain Anderson, commanding, in N. 34°, W. 73°, took a hurricane from sse. to sw. and w., lasting eight hours. The bark "J. B. Newcombe," Capt. J. B. Newcombe, commanding, on the 24th and 25th, in N. 36°, W. 72° (at 3.30 a. m. of the 25th), had a terrific hurricane from sse. to w., lasting twenty-four hours. The bark "Mohican," Capt. B. F. Berry, commanding, in N. 37° 10′, W. 71° 24′ (at 6 a. m. of the 25th), had a whole gale from sse. to wsw. The s. s. "Canada," in N. 40° 28′, W. 67° 12′ (at 12 midnight of the 25th), had a gale from e., backing to n., with very heavy rain; lowest barometer 29.44 (747.8).

The schooner "L. A. Plummer," Capt. Ezra Howes, commanding, on the 25th, in N. 40° 50′, W. 69° 10° (at 8 p. m.), had a hurricane from ene., backing to nw. The ship "Emily F. Whitney," Captain Rollins, commanding, on the 25th, in N. 39° 48′, W. 69° 15′ (at noon), had a hurricane from se., commencing at 10 p. m., with heavy seas; vessel shipped large quantities of water; hurricane continued on the 26th in N. 39° 29′, W. 69° 51′ (at noon), backing to e., ne., and nw., and moderated at 6 p. m.; barometer at noon of the 26th was 29.85 (758.2). The bark "Benj. F. Hunt, jr.," Capt. J. N. Pritchard, commanding, on the 25th, in N. 34° 22′, W. 69° 48′ (at noon), had a terrific gale from s., commencing at 10 p. m., and continued on the 26th, the wind shifting to w. and nw., and moderating after 4 p. m. The bark "John H. Pearson" had a heavy gale from e., backing to n. on the 25th, in N. 40° 40′, W. 68° 20°.

Capt. William Cassidy, commanding the bark "Harvester," reports: "August 25th, in N. 40° 33′, W. 66° 08′ (at noon), at 7 p. m., strong south breeze with very heavy thunder and lightning and rain; wind shifted to se.; wore ship on starboard tack, expecting a hurricane. 26th, at 9 a. m., gale increased; wind se., with a heavy sea, also a heavy sea coming up from the wsw., and breaking; at 1 p. m. the wind increased to hurricane force, with a very heavy sea, wsw., breaking. I thought it would drive the stern in; got two oil bags over which smoothed the sea to dead swell, and which I believe was the means of saving the ship. The hurricane lasted about eight hours, gradually drawing to the westward and from there to nw. in a strong gale, decreasing in violence. The lowest barometer reached was 29.20 (741.7). The s. s. "Camellia," Captain Buck, commanding, on the 25th, in N. 39° 20′, W. 69° 42′, had a very strong ene. gale shifting to n., and lasting from noon until 8 p. m.; barometer 29.48 (748.8); heavy squalls of wind and rain, and heavy seas.

7.—This storm was a continuation of land depression number v. and, passing north of east over Newfoundland during the 15th, was central on the morning of the 16th in about N. 52°, W. 49°, after which it moved northeastward beyond the region of observation. This storm exhibited considerable strength and caused heavy gales south of Newfoundland during the 15th.

The following special reports have been received relative to its passage:

The s. s. "Wisconsin," on the 15th, in N. 43° 50′, W. 54° 0′, had a strong gale, sw., veering to nnw.; lowest barometer, 29.59 (751.6), at 4 p. m. The s. s. "England," Capt. T. P. Heeley, commanding, had a moderate gale on the 14th and 15th, wind set in from sw. and veered to nw.; lowest barometer, 29.59 (751.6), at 6 a. m. of 15th, in N. 42° 23′, W. 60° 29′.

The s. s. "Wetherby," on the 15th, in N. 44° 38′, W. 57° 24°

(at noon), had a moderate gale, sw., with heavy squalls and rain, veering at 11 a. m. to nw. and moderating; lowest barometer, 29.52 (749.8), at 8 p. m. The ship "Andrew Jackson," Capt. A. Emery, commanding, on the 15th, in N. 44° 21′, W. 55° 51′, had a hurricane from the nw.; ship badly damaged.

8.—This storm was a continuation of land depression number vi, and passed north of east over the ocean south of Nova Scotia to N. 47°, W. 52° by the morning of the 18th, during which date it moved northeast beyond the limit of reports. This storm possessed great energy and occasioned considerable damage to property and shipping in the Maritime Provinces and over the adjoining ocean.

The following special reports have been rendered:

During the night of the 16th the storm was very severe along the coast of Maine. On the night of the 18th a violent storm swept over Saint Pierre. Advices from Saint John's, Newfoundland, state that it was the fiercest gale known for a quarter of a century, great damage being caused to property and shipping. The s. s. "Holland," Capt. Wm. Tyson, commanding, on the 17th and 18th, had a whole gale from s., veering to nw. The gale was of very short duration, blowing very heavy for a few hours, accompanied by torrents of rain; lowest barometer, 29.38 (746.2), at midnight of the 17th, in N. 44° 31′, W. 54° 27′.

The s. s. "Britannic," Capt. P. J. Irving, commanding, on the 18th, in N. 47° 35′, W. 46° 15′, had a fresh gale from s., veering to wnw., with very heavy head sea, which reduced the speed of the vessel to seven knots an hour; lowest barometer, 29.40 (746.7), at 9.30 a. m. The s. s. "La Bretague," had a whole gale on the 18th and 19th; wind set in from s. and veered to nw.; lowest barometer, 29.41 (747.0), at 5 p. m. of 18th, in N. 49° 15′, W. 41° 30′. The s. s. "Alaska," Captain Murray, commanding, on the 18th and 19th, had a fresh gale from ssw., veering to w.; lowest barometer, 29.75 (755.6), at midnight of 18th, in N. 49° 0′, W. 37°, 40′. The s. s. "Borderer," on 19th, in N. 45° 50′, W. 40° 31′, had a fresh gale, nw.

The ship "Andrew Jackson," on the 17th, in N. 44° 4′, W. 50° 15′, at 10 a. m., had a hurricane, sw., moderating from s., at 3 p. m. The s. s. "Norseman," on the 17th, in N. 43° 5′, W. 60° 0′, had a fresh gale, beginning at noon, from se., with very heavy rain; 2 p. m., strong gale, se., heavy squalls and thunder and vivid lightning from se.; wind veered to nw. at 6 p. m. and moderated; lowest barometer, 29.99 (761.7), at noon. The s. s. "Pietre de Connick," on the 17th and 18th, had a strong gale, beginning from sse, and veering to nnw., accompanied during the morning of the 18th by terrific thunder and lightning; lowest barometer, 29.64 (752.8), at 12 noon of the 18th, in N. 44° 15′, W. 50° 34′. The ship "Andrew Jackson," on the 18th, in N. 43° 20,′, W. 58° 55′, had a hurricane from s., beginning at noon; wind veered to w. and nw. as disturbance progressed. The captain stated that his barometers misled him in judging of the probable severity of the storm on account of their great errors; he had had no chance to have them compared for nearly a year.

The s. s. "Leerdam," Capt. H. Slierendregt, commanding, on the 18th, in N. 45° 45′, W. 57° 10′, had a heavy storm; wind set in from se., and veered to nw.; lowest barometer, 29.59 (751.6), at 1.30 a. m. The s. s. "City of Richmond," Captain Redford, commanding, on the 18th, in N. 45° 44′, W. 52° 0′, at 2 a. m., had a gale, force 9; wind changed from s. to w.; greatest force when s.; lowest barometer 29.38 (746.2). The s. s. "British Princess," Capt. E. H. Freeth, commanding, on the 18th, in N. 47° 10′, W. 45° 0′, barometer 29.90 (759.4), had a gale of force 10, from se., veering to w.; with high sea; lowest barometer 29.69 (754.1). Capt. G. Moodie, commanding the s. s. "State of Georgia," reports: "On the afternoon of the 18th the barometer began to fall rapidly and the wind backed from sw. to s. and sse., with heavy rains; at midnight the wind had veered to sw. and increased in force; from this time to noon of the 19th the wind reached force 10, and gradually veered to westward and nw., and began to moderate; during the afternoon a wild sea was running; slowed engines; lowest barometer, 29.48 (748.8), at 8 a. m. of the 19th, in N. 25° 35′, W. 34° 31′.

9 and **10.**—This storm was probably of tropical origin, but was not sufficiently well defined within the region of observation to admit of charting prior to the 20th; during this date it appeared in about N. 32°, W. 71°, and moved eastward to N. 33°, W. 62° by the 21st; it there circled northward to N. 40°, W. 65° 0′ by the 22d, whence it passed north and united with number 10 south of Nova Scotia. The path of the depression was marked by disturbances of extreme violence during the 20th, 21st, and 22d.

The following special reports were made in connection with this storm and its continuation, number 10, which continued land depression number x:

The bark "Argyll," Captain Smith, commanding, on the 20th, in N. 32° 10′, W. 71° 50′, had a gale from s., hauling around by e. to nw., and going around the compass three times in two and one-half hours, blowing with terrific force, accompanied by vivid lightning, terrific thunder, and torrents of rain, the sea being one mass of foam, breaking in all directions; the storm passed se., leaving the ship with a hard gale from the ne. The bark "Edwin Reed," Capt. C. W. Cate, commanding, on the 21st, in N. 33° 0′, W. 62° 25′, encountered a hurricane from e., veering to n. to sse., which blew with especial fury for four hours, injuring two of the crew and causing considerable damage to the vessel; lowest barometer, 28.40 (721.3), at 11 a. m. The bark "Theresina," on the 21st, in N. 33° 50′, W. 63° 0′, had a hurricane from ese., veering to n.

The s. s. "Victoria," Capt. A. A. Kurnmann, commanding, encountered a hurricane on the 21st, in N. 34° 47′, W. 62° 29′; wind set in from e., changed to n. during, and to ssw. following, the passage of the disturbance; lowest barometer, 28.45 (722.6), at midnight of 21st. The storm was accompanied by a tremendous cross sea which boarded the ship in large quantities; washing one man overboard, carrying away starboard rail and waist, and causing other damage. The s. s. "Rhynland," Capt. J. C. Jamison, commanding, had a whole gale on the 22d and 23d, from ne. backing to nw.; lowest barometer, 29.17 (740.9), at midnight of the 23d, in N. 41° 12′, W. 67° 0′.

The ship "Coringa," Capt. Morris Dexter, commanding, on the 22d, in N. 40° 30′, W. 67° 0′, experienced a hurricane; wind ssw., changing to e. and nw.; lowest barometer at 4 p. m. The s. s. "St. Ronans," Captain Campbell, commanding, on the 22d, at 9 p. m., in N. 42° 0′, W. 62° 45′, had a terrific gale; wind hauled to s. and sw. at 10.30 p. m. Third Officer Inkster, observer on the s. s. "The Queen," Capt. J. Milligan, commanding, reports: "Strong gale commenced from se. at 10 a. m. of 22d and ended at midnight same date; wind veered to w.; lowest barometer, 29.60 (751.8), at 11 p. m." The s. s. "Anchoria," Capt. J. J. Small, commanding, on the 24th, in N. 42°, W. 63° (at 2 p. m.), had a fresh gale from sw. to nw.; lowest barometer, 29.79 (756.7), at 2 p. m.

The bark "Toivo," Capt. H. W. Snellman, commanding, on the 22d, in N. 41° 01′, W. 66° 21′ (at 3 p. m.), had a hurricane; wind set in from e. and backed to nw. The hurricane was preceded by very heavy sea from sw., and accompanied by very heavy, badly chopped sea, and torrents of rain; lowest barometer, 29.25 (742.9), at 3 p. m. The s. s. "Persian Monarch," Capt. F. Paton, commanding, on the 23d, in N. 44°, W. 62° (at 4 p. m.), had a strong gale from s., veering to nw.; lowest barometer 29.70 (754.4). The s. s. "Canada," Capt. Thos. Foot, commanding, on the 24th, in N. 42° 16′, W. 61° 30′, had a fresh gale from ssw., veering to nw.; lowest barometer, 29.83 (757.7), at 4 p. m.

The s. s. "Servia," Capt. H. McKay, commanding, on the 22d, had a strong gale from ne., veering to s.; lowest barometer, 29.59 (751.6), at 4 p. m., in N. 40° 44′, W. 65° 15′; from 7 a. m. until 6 p. m. had constant and heavy rains, with very thick weather. First Officer Rilba, of the s. s. "Normandie," Capt. G. de Kersabiec, commanding, reports: "On the 22d, in N. 40° 45′, W. 66° 20′, had a hurricane from noon to 8 p. m.; wind set in from ne. and hauled slowly to sw., passing by e.,

se., and s., with force 10 to 12. The sea was monstrous and cross, coming from ene. and se. at the same time. The barometer fell to 29.02 (737.1), and rose from 8 p. m., as the wind abated. Very heavy rain fell during the hurricane."

11.—This depression first appeared on the 24th, in N. 41°, W. 67° and, moving rapidly eastward and northeastward, disappeared northwest of the British Isles during the 27th. The depression gathered strength as it moved eastward and developed considerable energy as it approached European waters.

The following are reports of vessels which came within its influence:

The s. s. "Columbia," Capt. T. Mitchell, commanding, had a strong gale from wsw. to nw. on the 25th and 26th; lowest barometer, 29.80 (756.9), at 5 p. m. of the 26th, in N. 41° 20′, W. 38° 08′. The s. s. "Matthew Bedlington," Capt. T. Kirby, commanding, had a whole gale, commencing at 10 p. m. of the 26th and ending at midnight of the 27th; wind set in from ne., and veered to west; lowest barometer, 29.20 (741.7), at 3 p. m. of the 27th; position at noon of the 27th, N. 51° 46′, W. 24° 34′. Chief Officer O. Griffiths, of the s. s. "Catalonia," Capt. Alex McKay, commanding, reports: "August 27th, in N. 50° 15′, W. 21° 16′, strong breeze at noon from s., veering to ssw., and increasing at 4 p. m. to fresh gale and high squalls; veered to w. in a. m. of 28th, in N. 50° 27′, W. 27° (at noon), with heavy seas; lowest barometer, 29.42 (747.3), at 4 p. m. of 27th."

The s. s. "Normandie," on the 26th, in N. 48° 10′, W. 35° 50′, encountered a strong gale ene., lasting ten hours, with heavy rain and very high seas. The wind shifted to n. following the passage of the disturbance. The s. s. "Sulina," Capt. Thomas Potter, commanding, on the 26th had a storm from e. backing to nnw.; gale commenced at 3.42 a. m.; was at its height, from ne., force 11, at 11.42 a. m., with barometer 29.62 (752.3); position at 1.30 p. m., N. 45° 46′, W. 37° 18′; rain during the morning. The s. s. "Australia," Capt. G. Franck, commanding, on the 26th, in N. 48° 3′, W. 31° 30′, had a storm commencing at noon from ne.; wind veered to ese. and backed to ene., increasing until 7 p. m., when it blew strongest from ene., with thunder and lightning; sky then cleared, with heavy squalls from ne. and n.

12.—This was a continuation of land depression number xiii, and passed north of east over the northern portion of Newfoundland during the early morning of the 28th; continuing this course it advanced rapidly to N. 54°, W. 29° by the 29th, during which date it disappeared to the northward of the region of observation. While this depression had considerable depth its track was too far north to cause violent disturbance in and south of the trans-Atlantic track.

The following special reports have been submitted relative to this storm:

The s. s. "Prussian," Capt. A. McDougall, commanding, on the 30th, had a strong gale, commencing at 1 p. m. and ending at midnight; lowest barometer, 29.45 (748.0), at 6 p. m., in N. 52° 40′, W. 20° 27′. The s. s. "Catalonia," encountered a moderate gale from sw., veering to nw., on the 29th, continuing until 8 a. m. of the 30th, in N. 48° 54′, W. 37° 39′ (at noon); lowest barometer, 29.38 (746.2), at 8 a. m of the 29th. The s. s. "Rhynland," Capt. J. C. Jamison, commanding, had a strong gale on the 29th and 30th, from s., veering to sw; lowest barometer, 29.21 (741.9), at 6.56 p. m. of the 30th, in N. 50° 26′, W. 21° 24′.

Advices of the 31st indicated the presence of a storm of considerable energy off the eastern coast of the United States, between the thirty-fifth and forty-fifth parallels, but the regular reports at hand will not admit of accurately locating its centre.

In connection with this storm the following special reports have been received:

Capt. W. T. Bacon, commanding the bkt. "Harriet S. Jackson," reports: "31st, in N. 37° 50′, W. 71° 30′ (at noon). The day opened with dark, gloomy weather, and a heavy bank of clouds hanging in the sw. and south, from which portions frequently detached themselves and drifted to ne., causing heavy showers. During the afternoon a heavy south wind set in, with torrents of rain and heavy confused sea, which conditions continued until 9.45 p. m. when there was a sudden shift of wind to north; the barometer at this time fell to 29.73 (755.1), not so much of a fall, but very unsteady, seesawing up and down, leading me to believe there was a storm-centre near by."

Chief Officer Smith, of the s. s. "Warwick," Captain James, commanding, reports having encountered a strong gale, of force 9, on the 31st; wind set in from s. and veered to n.; lowest barometer, 29.83 (757.7), at 8 a. m. of September 1st, in N. 42° 12′, W. 64°. Capt. J. Raeburn, commanding the s. s. "Willesden," reports: "August 31st, in N. 33° 50′, W. 75° 8′ (at noon), a strong gale began in a. m. from sw., with rain, and continued through p. m.; at 8 p. m. heavy dark clouds in sw,; threatening, violent squalls passed over without increasing wind; at this time had extraordinary rip currents, the sea being tossed in foam in a remarkable manner and lashed into a confused state; these rip currents of foam seemed to move in waves from nw. to se., at 8 p. m. (about off Cape Hatteras). These rip currents of foam were, at the time, attributed to counter currents from the Gulf Stream, but now think they were caused by the earthquake in the Carolinas; 11 p. m., wind veered in violent squalls to nw., and moderated at midnight; lowest barometer, 29.53 (750.0), at 2 p. m." The s. s. "France," Captain Hadley, commanding, on the 31st, in N. 41° 57′, W. 63° 50′ (at 8 p. m.), had a storm, of force 11, from s., veering to north; lowest barometer, 29.82 (757.4), in position above cited.

OCEAN ICE.

On chart i are also exhibited the eastern and southern limits of the region within which icebergs and field ice have been reported during August, 1886. These limits have been determined from reports furnished by shipmasters, and from trustworthy data published in the "New York Maritime Register" and other newspapers.

During this month the easternmost ice was encountered on the 6th, in N. 50°, W. 48°, and the southernmost ice reported was observed in N. 48° 35′, W. 48° 46′, on the 4th; in each instance the icebergs were isolated. In the Strait of Belle Isle, and eastward in the track of trans-Atlantic vessels to the fifty-second meridian, icebergs were encountered during the first half of the month, but one report, for the 25th, showing ice in that locality after the 14th. Although ice is not commonly encountered in quantities in the trans-Atlantic tracks during August, the area within which it appeared during August of the present year was unusually small. In this connection it is also of interest to note that vessel reports show that the water temperature was appreciably higher than the average for August.

A comparison with the chart for the preceding month (July, 1886), shows the number of icebergs to be largely diminished, and the area within which they were observed to be greatly contracted to the northward and westward. In July they were most numerous to the eastward of Newfoundland, between the forty-eighth and forty-ninth parallels, while during the present month they were not encountered in numbers south of the fifty-second parallel nor east of the fifty-second meridian.

The following table shows the comparison between August, 1886, and the four preceding years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Lon. W.	Month.	Lat. N.	Lon. W.
	° ′	° ′		° ′	° ′
August, 1882	46 59	46 00	August, 1882	46 59	46 00
August, 1883	43 26	51 41	August, 1883	48 00	44 00
August, 1884	43 24	48 44	August, 1884	47 50	43 50
August, 1885	43 48	52 04	August, 1885	48 03	42 45
August, 1886	48 35	48 46	August, 1886	50 00	48 00

Icebergs were reported during the month, as follows:

4th.—The s. s. "La Champagne," in N. 48° 35′, W. 48° 46′, passed a small iceberg.

6th.—A large iceberg was observed in N. 50°, W. 48°.

9th.—The s. s. "Montreal" passed several icebergs in the Strait of Belle Isle, a few outside, but none east of the fifty-second meridian.

12th.—The s. s. "Circassian," in N. 52° 34′, W. 53° 40′, passed an iceberg. The s. s. "Ontario," in N. 52° 8′, W. 51° 53′, passed a large iceberg; passed several large bergs in Belle Isle Strait, as far west as Greenly Island; saw the easternmost iceberg one hundred and thirty miles east of Belle Isle.

13th.—The s. s. "Buenos Ayrean" passed one iceberg in N. 52° 22′, W. 53° 13′; one in N. 52° 12′, W. 53° 56′; two twelve miles southeast off Belle Isle; five in the Strait of Belle Isle; and one three miles off Point Amour, in the track of ships. The s. s. "Circassian" passed several icebergs between Belle Isle and Cape Norman, and three icebergs off Point Amour.

14th.—An iceberg observed in N. 52° 14′, W. 53° 40′.

25th.—The s. s. "Norwegian" passed three icebergs near Belle Isle.

SIGNAL SERVICE AGENCIES.

Signal Service agencies have been established in the Maritime Exchange buildings at New York City and Philadelphia, and in the Custom-House, Boston, where the necessary blanks and other information will be furnished to ship-masters.

In pursuance of the arrangements made with the Meteorological Office of London, England, there were cabled to that office from New York during August, 1886, seven reports concerning storms and icebergs encountered by vessels in the Atlantic west of the forty-fifth meridian.

TEMPERATURE OF THE AIR.

[*Expressed in degrees, Fahrenheit.*]

The distribution of mean temperature over the United States and Canada for August, 1886, is exhibited on chart ii by the dotted isothermal lines; and in the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. On chart iv the departures from the normal temperature are illustrated by lines connecting stations of normal or equal abnormal values.

By chart iv it will be seen that the August, 1886, temperature corresponds in some respects with the mean temperature for July, the temperature for both months being below the normal over all parts of the country lying east of the Mississippi River, and above, from the Mississippi westward to the Pacific Ocean. During the month the largest departures in excess of the normal occur in the Missouri and upper Mississippi valleys, especially in Iowa, northern Minnesota and Dakota, and Montana. Although the western part of the country is above the normal generally, several exceptions are noted, viz., Sacramento and San Francisco, California; Fort Verde and Yuma, Arizona; Santa Fé, New Mexico; these stations are about normal or slightly below. With a few exceptions the mean temperature has been below the normal at all stations lying east of the Mississippi River, the largest departures occurring along the coast of the middle Atlantic states, where they averaged about 2°.0.

The following are some of the most marked departures from the normal temperature at Signal Service stations:

Above normal.	°	Below normal.	°
Des Moines, Iowa	4.3	Portland, Maine	3.0
Fort Davis, Texas	3.8	Oswego, New York	2.9
Fort Shaw, Montana	3.6	Norfolk, Virginia	2.6
Saint Louis, Missouri	3.3	Nashville, Tennessee	2.5
Fort Elliott, Texas	3.2	Cape Henry, Virginia	2.2
Fort Sill, Indian Territory	3.2	Rochester, New York	2.1
Fort Thomas, Arizona	3.1	New Haven, Connecticut	2.0
Fort Maginnis, Montana	3.0	Augusta, Georgia	2.0

RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of temperature, are given in the table of miscellaneous meteorological data.

The following are some of the greatest and least monthly ranges at Signal Service stations:

Greatest.	°	Least.	°
Fort Totten, Dakota	73.8	Fort Canby, Washington Territory	14.7
Fort Yates, Dakota	72.5	Tatoosh Island, Washington Ter.	18.6
Bismarck, Dakota	70.5	Cape Hatteras, North Carolina	18.8
Saint Vincent, Minnesota	70.2	San Diego, California	21.1
Fort Buford, Dakota	69.4	Fort Macon, North Carolina	21.6
Poplar River, Montana	68.4	Galveston, Texas	23.1
Moorhead, Minnesota	68.2	Pensacola, Florida	25.3
Fort Custer, Montana	67.9	Block Island, Rhode Island	25.5

Table of comparative maximum and minimum temperatures for August.

State or Territory.	Station.	For 1886.		Since establishment of station.			
		Max.	Min.	Max.	Year.	Min.	Year.
		°	°	°		°	
Alabama	Mobile	97.0	67.4	100.0	1874	63.0	1884
Do	Montgomery	97.8	66.4	103.0	1874	61.5	1879
Arizona	Prescott	92.8	55.5	99.0	1876	38.0	1876
Do	Fort Apache	97.0	53.3	98.1	1885	41.0	1880
Arkansas	Fort Smith	104.5	57.1	105.7	1884	57.1	1885
Do	Little Rock	.....	.....	102.0	1881	59.2	1884
California	San Francisco	84.6	48.4	89.0	1879	50.0	'75, '79, '82
Do	San Diego	82.5	61.4	91.5	1884	54.0	1879, 1884
Colorado	Denver	94.3	48.5	105.0	1878	44.0	1876
Do	Pike's Peak	51.2	29.0	62.0	1878	15.0	1882
Connecticut	New Haven	85.6	47.8	90.0	'73, '76, '81, '84	45.1	1885
Do	New London	83.7	49.8	90.0	1873	47.5	1884
Dakota	Fort Buford	103.9	34.5	107.0	1882	30.0	1883
Do	Yankton	99.1	40.7	103.0	1873	45.0	1875
Delaware	Del. Breakwater	.....	.....	93.0	1881	60.0	1881
District of Columbia	Washington City	92.0	55.8	101.0	1881	50.0	1874
Florida	Jacksonville	93.8	64.9	100.0	1874	66.0	1874, 1875
Do	Key West	100.0	73.1	95.4	1881	72.0	1882, 1884
Georgia	Atlanta	94.0	62.0	96.2	1881	57.0	1879
Do	Savannah	93.2	65.8	100.0	1878	63.0	1879
Idaho	Boisé City	97.5	48.5	103.0	1879	39.0	1881
Illinois	Cairo	97.0	57.8	103.0	1881	54.5	1885
Do	Chicago	91.6	53.0	98.0	1874	47.0	1882
Indiana	Indianapolis	92.2	53.0	101.0	1881	47.7	1885
Indian Territory	Fort Sill	104.0	62.0	105.0	1881	53.0	1880
Iowa	Dubuque	97.4	45.5	97.3	1881	41.0	1875
Do	Keokuk	99.1	53.4	102.0	1873	47.0	1875
Kansas	Dodge City	.....	.....	101.6	1881	50.0	1880
Do	Leavenworth	106.8	52.2	107.0	1874	50.0	1884
Kentucky	Louisville	94.3	59.1	104.6	1881	52.4	1885
Louisiana	New Orleans	94.7	67.8	96.3	1877	69.0	1879
Do	Shreveport	101.0	63.8	105.0	1881	58.0	1880
Maine	Eastport	81.6	47.0	88.0	1880	45.0	1880
Do	Portland	87.0	49.3	95.0	1876	47.5	1885
Maryland	Baltimore	92.0	58.1	98.0	1881	52.0	1874
Massachusetts	Boston	90.4	49.3	96.8	1881	47.0	1880
Michigan	Detroit	89.3	51.5	96.8	1881	45.0	1875
Do	Alpena	90.3	44.0	92.0	1878	39.0	1884
Minnesota	Duluth	92.1	40.5	93.0	1881	43.8	1885
Do	Saint Paul	94.2	42.1	98.0	1880	43.0	1875
Mississippi	Vicksburg	96.3	66.1	100.0	1878	61.8	1885
Missouri	Saint Louis	102.0	61.0	106.4	1881	53.5	1885
Montana	Fort Benton	100.0	37.9	108.0	1881	34.0	1881
Do	Helena	93.1	47.6	95.0	1880	34.0	1880
Nebraska	North Platte	99.2	44.7	103.0	1878	42.0	1876
Do	Omaha	99.0	43.6	105.0	1874	49.0	1877
Nevada	Winnemucca	90.7	43.8	102.5	1882	32.0	1880
New Hampshire	Mount Washington	68.9	28.3	74.0	1872	20.0	1876
New Jersey	Atlantic City	86.5	55.3	91.8	1881	48.8	1885
Do	Sandy Hook	89.2	79.1	96.2	1881	54.9	1885
New Mexico	Santa Fé	80.0	51.0	97.0	1878	40.0	1882
New York	Buffalo	86.2	47.2	90.8	1881	44.0	1880
Do	New York City	87.7	57.8	96.0	1881	51.0	1885
North Carolina	Charlotte	91.9	56.4	100.5	1881	55.8	1885
Do	Wilmington	92.8	60.2	99.0	1878	56.0	1874
Ohio	Cincinnati	90.8	56.9	101.0	1881	50.9	1885
Do	Cleveland	89.5	51.0	98.7	1881	45.6	1876, 1885
Oregon	Portland	89.6	48.2	94.5	1885	43.0	1876
Do	Roseburg	93.8	46.1	97.2	1884	40.0	1882
Pennsylvania	Pittsburg	92.6	51.8	99.8	1881	47.4	1885
Do	Philadelphia	91.8	56.1	99.0	1881	51.1	1885
Rhode Island	Block Island	80.0	54.5	81.0	1882	52.9	1885
South Carolina	Charleston	92.0	66.2	97.5	1881	62.0	1879
Tennessee	Knoxville	93.2	58.2	100.0	1881	50.0	1879
Do	Nashville	97.7	58.7	104.0	1874	54.7	1883
Texas	Fort Davis	96.0	58.9	100.0	1884	47.0	1882
Do	Galveston	94.4	71.3	98.5	1874	70.0	'77, '80, '82
Utah	Salt Lake City	99.1	55.2	101.0	1875	44.0	1880
Virginia	Lynchburg	91.8	57.3	100.0	1881	50.0	1874
Do	Norfolk	92.8	64.4	99.0	1881	58.0	1874
Washington Ter.	Spokane Falls	95.6	45.5	101.5	1882	38.0	1881, 1882
Do	Olympia	86.0	44.6	92.2	1885	41.0	1880, 1882
Wisconsin	La Crosse	91.3	48.8	96.0	1874, 1881	43.8	1885
Do	Milwaukee	92.7	47.8	98.0	1874	43.0	1875
Wyoming	Cheyenne	.....	.....	96.1	1882	34.0	1876

DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures for

August for a series of years, the mean temperature for August, 1886, and the departures from the normal:

Station.	County.	Normal temperature for August.	Number of years.	Mean temperature for Aug., 1886.	Departure.
Arkansas.		°		°	°
Lead Hill	Boone	76.7	4	81.0	+ 4.3
California.					
Sacramento	Sacramento	71.0	30	72.2	+ 1.2
Connecticut.					
Middletown *	Middlesex	68.8	28	67.4	— 1.4
New Haven *	New Haven	70.2	100	68.2	— 2.0
Thompson *	Windham	67.5	30	66.8	— 0.7
Dakota.					
Webster	Day	72.4	4	71.8	— 0.6
Illinois.					
Anna	Union	76.6	11	77.9	+ 1.3
Mattoon	Coles	75.7	6	77.0	+ 1.3
Peoria	Peoria	75.2	30	78.8	+ 3.6
Riley	McHenry	68.4	25	69.6	+ 1.2
Sycamore	De Kalb	68.9	5	70.2	+ 1.3
Indiana.					
Lafayette	Tippecanoe	72.7	7	74.0	+ 1.3
Logansport	Cass	73.7	31	74.4	+ 0.7
Spiceland	Henry	71.5	32	70.6	— 0.9
Vevay	Switzerland	75.9	21	74.9	— 1.0
Iowa.					
Monticello	Jones	70.2	33	73.5	+ 3.3
Kansas.					
Atchison	Atchison	75.5	22	74.9	— 0.6
Independence	Montgomery	78.4	15	78.4	0.0
Lawrence	Douglas	75.8	19	79.0	+ 3.2
Wellington	Sumner	76.3	8	78.6	+ 2.3
Yates Centre	Woodson	75.5	6	76.5	+ 1.0
Maine.					
Belfast *	Waldo	65.2	27	64.3	— 0.9
Bridgeton *	Cumberland	67.5	12	65.1	— 2.4
Cornish	York	66.4	29	65.8	— 0.6
Gardiner	Kennebec	66.6	50	64.7	— 1.9
Orono *	Penobscot	65.8	18	65.6	— 0.2
Maryland.					
Fallston	Harford	71.6	13	70.9	— 0.7
Massachusetts.					
Amherst *	Hampshire	68.3	49	68.3	0.0
Cambridge *	Middlesex	69.6	64	67.5	— 2.1
Fitchburg *	Worcester	67.9	30	66.5	— 1.4
New Bedford *	Bristol	68.3	74	66.6	— 1.7
Somerset	Bristol	72.0	16	70.4	— 1.6
Springfield *	Hampden	70.6	19	70.0	— 0.6
Taunton	Bristol	72.4	16	67.5	— 4.9
Worcester	Worcester	68.2	50	66.1	— 2.1
Nevada.					
Carson	Ormsby	69.3	7	72.1	+ 2.8
New Brunswick.					
Saint John *	Saint John	60.2	26	60.2	0.0
New Hampshire.					
Concord *	Merrimac	68.1	18	66.2	— 1.9
Hanover *	Grafton	66.7	17	65.2	— 1.5
New Jersey.					
South Orange	Essex	71.0	16	68.0	— 3.0
New York.					
North Volney	Oswego	68.0	19	67.9	— 0.1
Palermo	Oswego	64.5	32	65.3	+ 0.8
Plattsburg Barracks	Clinton	67.9	17	67.6	— 0.3
Ohio.					
Wauseon	Fulton	69.6	16	69.5	— 0.1
Westerville	Franklin	68.8	12	70.0	+ 1.2
Pennsylvania.					
Dyberry	Wayne	65.2	19	64.5	— 0.7
South Carolina.					
Stateburg	Sumter	77.7	6	77.2	— 0.5
Texas.					
New Ulm	Austin	82.5	15	84.0	+ 1.5
Vermont.					
Lunenburg*	Essex	65.4	38	64.5	— 0.9
Newport *	Orleans	67.1	12	65.9	— 1.2
Strafford *	Orange	67.9	12	68.1	+ 0.2
Virginia.					
Bird's Nest	Northampton	77.0	18	78.1	+ 1.1
Dale Enterprise	Rockingham	75.1	6	76.4	+ 1.3
Variety Mills	Nelson	73.1	9	72.0	— 1.1
Wytheville	Wythe	70.4	22	69.3	— 1.1
Washington Territory.					
Bainbridge Island	Kitsap	65.0	9	66.0	+ 1.0
West Virginia.					
Helvetia	Randolph	67.5	10	67.0	— 0.5

* From the "Bulletin of the New England Meteorological Society."

The following notes, in connection with this subject, are furnished by voluntary observers:

Illinois.—Riley, McHenry county: the mean temperature of the summer of 1886, 68°.4, is 0°.3 above the average of the twenty-five preceding summers.

Indiana.—Logansport, Cass county: during the past thirty-one years the highest August temperature occurred in 1881, 104°.0; the lowest in that time in 1863, 36°.0.

Spiceland, Henry county: the highest August temperature during the past thirty-two years occurred in 1881, 101°.0; the lowest in 1863, 35°.0.

Vevay, Switzerland county: during the past twenty-one years unusually high August temperatures occurred in 1866, 96°.0; 1867, 98°.0; 1871, 1872, 1878, 1879, 96°.0; and in 1881, 104°.0. The lowest occurred in 1866, 50°.0, and 1884, 51°.0.

Iowa.—Monticello, Jones county, during the past thirty-three years the highest August temperature, 98°.0, occurred in 1870; the lowest, 36°.0, in 1863; the highest mean temperature, 77°.1, in 1861; the lowest mean temperature, 64°.1, in 1863.

Kansas.—Lawrence, Douglas county: during the past eighteen Augusts the highest temperature, 108°.0, occurred in 1874; the highest mean temperature, 82°.8, also occurred in 1874; the lowest temperature, 45°.0, in 1871; the lowest mean temperature, 71°.1, in 1884. August, 1886, is one of the three warmest on record, viz., 1874, 82°.8; 1881, 81°.2; 1886, 79°.0. There were eleven days with temperature below the average for the season, but the remaining twenty days were excessively hot, and the week from the 11th to the 17th surpassed any week upon the record kept since 1874.

Kansas.—Wellington, Sumner county, during the eight preceding Augusts the highest temperature, 105°.0, occurred in 1881; the lowest, 47°.0, in 1880.

Yates Centre, Woodson county: the normal temperature of the summer months, as deduced from six years' observations, is 75°.1; the temperature of the corresponding period of 1886 is 0°.2 above the normal.

Maine.—Cornish, York county: during the past twenty-nine years the warmest August occurred in 1876; mean temperature, 73°.3; the coldest in 1866, 62°.4.

Maryland.—Fallston, Harford county: the warmest August in the past thirteen years is that of 1872, 75°.9; the coldest, 1875, 69°.7.

New York.—Palermo, Oswego county; during the thirty-two preceding Augusts the highest mean occurred in 1887, 71°.6; the lowest in 1866, 62°.1.

North Volney, Oswego county: during the past nineteen years the highest mean August temperature occurred in 1872, 71°.3; the lowest mean in 1885, 63°.2; the mean summer temperature, as deduced from the observations of eighteen years, is 67°.3; the mean temperature of the summer of 1886 is 1°.1 below the average.

Ohio.—Wauseon, Fulton county: the highest mean temperature for the sixteen preceding Augusts, 72°.8, occurred in 1872; the lowest mean, 63°.0, in 1870; the August extremes for that period are, 102°.0 in 1874, and 38°.9 in 1884. The mean temperature of the summer of 1886, 70°.0, is 0°.1 below the normal.

Westerville, Franklin county: temperature comparisons of the past twelve Augusts: highest mean, 71°.8, in 1881; lowest mean, 65°.5, in 1885; maximum, 91°.5, in 1884; minimum, 34°.0, in 1875.

Texas.—New Ulm, Austin county: temperature comparisons of the past fifteen Augusts: highest mean, 84°.4, in 1873, lowest mean, 79°.4, in 1882; maximum, 108°.0, in 1876; minimum, 63°.5, in 1885. The mean temperature of the summer of 1886, 83°.0, is 1°.1 above the normal.

Virginia.—Dale Enterprise, Rockingham county: in the past six years the warmest August occurred in 1883, mean temperature, 77°.7.

Variety Mills, Nelson county: during the past nine years the warmest August occurred in 1881, mean temperature, 76°.1; the coldest in 1883, mean temperature, 70°.8. The mean temperature of the summer of 1886, 71°.5, is 1°.8 below the normal.

In the following table are given the mean temperatures for the several geographical districts, with the normals and departures, as deduced from Signal Service observations:

Average temperatures for August.

Districts	Average for August, Signal-Service observations.		Comparison of August, 1886, with the average for several years.
	For several years.	For 1886.	
	°	°	°
New England	68.1	66.5	— 1.6
Middle Atlantic States	74.0	72.7	— 1.3
South Atlantic States	78.3	77.0	— 1.3
Florida Peninsula	81.8	81.4	— 0.4
Eastern Gulf States	79.2	79.2	0.0
Western Gulf States	80.9	81.3	+ 0.4
Rio Grande Valley	83.2	83.3	+ 0.1
Tennessee	76.8	76.2	— 0.6
Ohio Valley	74.6	73.8	— 0.8
Lower Lake region	69.8	68.9	— 0.9
Upper Lake region	66.1	65.5	— 0.6
Extreme Northwest	65.2	66.6	+ 1.4
Upper Mississippi Valley	73.3	75.3	+ 2.0
Missouri Valley	72.4	74.4	+ 2.0
Northern slope	66.5	68.8	+ 2.3
Middle slope	72.0	74.2	+ 2.2
Southern slope	75.6	79.0	+ 3.4
Southern plateau	76.4	77.1	+ 0.7
Middle plateau	72.6	74.0	+ 1.4
Northern plateau	69.7	71.1	+ 1.4
North Pacific coast region	64.1	65.5	+ 1.4
Middle Pacific coast region	70.5	70.5	0.0
South Pacific coast region	76.6	77.3	+ 0.7

HIGH TEMPERATURES.

Saint Vincent, Minnesota: the Signal Service observer reports concerning an unusually high temperature, and other phenomena, on the 24th, as follows:

The morning opened with falling pressure, rising temperature, and variable northeasterly winds. Toward midday the wind increased, and at 1.30 p. m.

it had freshened into a gale, which was accompanied by intense and suffocating heat, that penetrated houses and even cellars, to the great discomfort of the inhabitants. Streams of heated air could be seen rising from the earth, the roofs of houses and objects near the surface appeared to be wrapped in a whitish glare. At 3.35 p. m. the thermometer stood at 103°.2, the highest temperature ever recorded at this station. Towards evening the heat abated somewhat, falling to 81°.3 at 11 p. m. The gale ended at 6.50 p. m., having reached its maximum velocity of twenty-seven miles from the south between 2 and 3 p. m. At 5 p. m. of the 25th a gale set in from the southwest, and was also accompanied by a high temperature, the maximum being 102°.0.

FROSTS.

During the latter part of the month telegrams were issued by the Chief Signal Officer to observers in Dakota, Nebraska, northern Wisconsin and Michigan, and western Minnesota, predicting frosts in those localities. The telegrams are given below, also the reports of frost, as received from Signal Service and voluntary observers:

The following telegram was sent to observers at La Crosse, Wisconsin; Duluth, Minnesota; Marquette, Escanaba, Alpena, and Mackinaw City, Michigan:

WASHINGTON CITY, *August* 29, 1886—6.36 p. m.

Cool wave approaching; frosts are indicated for northern Michigan and northern Wisconsin to-morrow night.

Observers at Saint Paul, Minnesota, Huron and Yankton, Dakota, received the following telegram:

WASHINGTON CITY, *August* 29, 1886—6.40 p. m.

Cool wave approaching; frosts are indicated for Dakota and western Minnesota to-morrow morning.

The observers at North Platte and Omaha, Nebraska, received the following telegram:

WASHINGTON CITY, *August* 30, 1886—10.16 a. m.

Light frosts are indicated for to-night in Nebraska.

The following reports of frost will serve to show that these warnings were justified:

Richardton, Stark county, Dakota: the first frost of the season occurred here on the morning of the 30th, killing an amount of vegetables.

Huron, Dakota: a heavy frost occurred here on the morning of the 31st; late corn, flax, and all kinds of vines were injured, in many cases destroyed.

Alta, Marshall county, Dakota: corn and other crops were injured by frost on the morning of the 31st.

Fort Yates, Dakota: a killing frost occurred on the morning of the 31st; minimum temperature, 31°.7.

Webster, Day county, Dakota: on the morning of the 31st the first frost of the season occurred, killing corn, vines, etc. Ice formed one-tenth of an inch thick on standing water; minimum temperature, 31°.0. Frost was also reported from Fort Totten and Yankton on the 31st.

Hay Springs, Sheridan county, Nebraska: a very light frost occurred on the 31st in the lowlands six miles south of this place. No injury was done to vegetation. Frost was also reported from Valentine, Nebraska, on the 31st.

Frosts were reported from Michigan, at Reed City, Allegan, Greeneville, Hudson, and Traverse City, on the 31st; from Minnesota, at Duluth, Moorhead, and Saint Vincent, on the 31st; from Wisconsin, at Embarras and Fond du Lac, on the 31st.

The following is from the "Evening Wisconsin," of August 31st, published at Milwaukee:

The frost warnings for northern Wisconsin, sent out by the Signal Service yesterday, were verified, as light frosts are reported this morning along the valley division of the Saint Paul road and in the marshes around Berlin. The report from Berlin, received at the Saint Paul railroad office, adds that the frost was light and did no damage. The minimum mercury recorded at the government observatory in Milwaukee was 48°, the lowest since June 8th, when 42°.4 was recorded. The next lowest was 49°, July 18th. At Escanaba, Michigan, 42° was the minimum; at Marquette, Michigan, 45°; at Duluth, Minnesota, 40°; at Saint Paul, Minnesota, 42°; at La Crosse, Wisconsin, 49°; at Des Moines, Iowa, 46°; at Fargo, Dakota, 32°; at Huron, Dakota, 33°; at Saint Vincent, Minnesota, 38°; at Bismarck, Dakota, 34°; at Assinaboine, Montana, 38°.

Frosts were also reported to have occurred in the various states and territories, as follows:

Boston, Massachusetts: light frost occurred in parts of the surrounding country on the morning of the 23d. Considerable damage was done to the cranberry crop in Norfolk county.

Lansing, Michigan: frost is reported as having occurred near Lansing on the 2d, doing considerable damage to corn.

Colorado.—Pike's Peak, 21st.

Connecticut.—North Colebrook, 22d, 23d.

Iowa.—Oskaloosa, 29th, 30th; Dubuque, Bancroft, Cedar Rapids, Independence, Logan, Manchester, and Monticello, 31st.

Massachusetts.—Dudley, 3d; Westborough, 23d.

Michigan.—Marquette, 2d, 18th; Mackinaw City, 4th.

Nevada.—Carson City, 21st.

New Hampshire.—Mount Washington, 7th, 17th, 18th, 21st, 31st; Nashua, 23d.

New York.—North Volney, 6th.

Ohio.—Wauseon, 3d.

Oregon.—Fort Klamath, 9th, 22d, 26th; Lakeview, 17th, 21st, 22d.

Pennsylvania.—Wellsborough and Grampian Hills, 4th; Dyberry, 23d.

TEMPERATURE OF WATER.

The following table shows the highest and lowest temperatures of water observed at the several stations; the monthly ranges of water temperature; the average depth at which the observations were made; and the mean temperature of the air:

Temperature of water for August, 1886.

Station.	Temperature at bottom.		Range.	Average depth, feet and tenths.	Mean temperature of the air at station.
	Max.	Min.			
	°	°	°		°
Atlantic City, New Jersey	78.0	66.0	12.0	11.5	71.4
Alpena, Michigan	69.6	63.6	6.0	12.2	62.8
Augusta, Georgia	86.3	74.3	12.0	8.3	77.6
Baltimore, Maryland	80.1	75.5	4.6	12.0	73.5
Block Island, Rhode Island	66.6	63.1	3.5	8.5	67.2
Boston, Massachusetts	69.2	59.1	10.1	20.4	67.7
Buffalo, New York	75.0	69.9	5.1	10.8	67.5
Cedar Keys, Florida	86.8	78.7	8.1	8.6	80.8
Charleston, South Carolina	85.1	79.4	5.7	37.9	77.4
Chicago, Illinois	73.2	67.3	5.9	8.6	72.4
Chincoteague, Virginia	84.6	71.0	13.6	3.8	73.2
Cleveland, Ohio	75.0	71.7	3.3	14.0	69.5
Detroit, Michigan	73.7	68.0	5.7	20.7	70.2
Duluth, Minnesota	69.5	58.8	10.7	10.4	63.9
Eastport, Maine	52.8	50.3	2.5	17.2	59.2
Escanaba, Michigan	68.4	62.8	5.6	18.5	62.8
Galveston, Texas	89.1	82.7	6.4	13.6	83.2
Grand Haven, Michigan	75.1	64.0	11.1	19.0	67.1
Indianola, Texas *					
Jacksonville, Florida	88.7	82.7	6.0	18.0	80.4
Key West, Florida	89.8	83.8	6.0	18.8	84.9
Mackinaw City, Michigan	67.5	60.2	7.3	10.0	63.6
Macon, Fort, North Carolina	86.1	74.1	12.0	12.9	70.5
Marquette, Michigan	69.3	54.6	14.7	12.2	62.8
Milwaukee, Wisconsin *					
Mobile, Alabama	89.5	84.1	5.4	17.6	79.9
New Haven, Connecticut †	75.4	69.8	5.6	16.9	68.2
New London, Connecticut	75.6	66.6	9.0	13.3	67.9
New York City	74.7	71.1	3.6	15.6	71.0
Norfolk, Virginia	81.2	74.2	7.0	16.1	74.5
Pensacola, Florida	85.2	75.9	9.3	17.5	80.9
Portland, Maine	61.9	54.1	7.8	17.6	64.7
Portland, Oregon	74.4	68.0	6.4	51.5	66.8
Sandusky, Ohio	76.0	71.5	6.5	11.3	70.3
Sandy Hook, New Jersey	74.4	69.3	5.1	13.1	71.8
San Francisco, California	61.3	58.4	2.9	38.0	58.5
Savannah, Georgia	83.7	78.7	5.0	9.7	79.9
Smithville, North Carolina	84.6	78.5	6.1	11.0	77.4
Toledo, Ohio	77.1	72.1	5.0	13.6	69.3
Wilmington, North Carolina	82.1	76.1	6.0	9.7	77.0

* Observations temporarily suspended. † Record for 24 days.

PRECIPITATION.

[*Expressed in inches and hundredths.*]

The distribution of rainfall over the United States and Canada for August, 1886, as determined from the reports of about seven hundred stations, is exhibited on chart iii.

The most noted feature in connection with the precipitation of the month is its inequality within small distances, thus at Rochester, New York, the rainfall is 4.31 in excess of the normal, while Buffalo, New York, shows a deficiency of 0.65; Indianapolis, Indiana, excess, 3.42; Cincinnati, Ohio, defi-

ciency, 1.17; Keokuk, Iowa, excess, 2.81; Des Moines, Iowa, deficiency, 3.75; Fort Yates, Dakota, excess, 2.93; Bismarck, Dakota, deficiency, 1.26, etc. The rainfall is, however, generally below the normal in the Lake region, Gulf region, south Atlantic states, Florida, upper Mississippi valley, extreme northwest, Montana, and along the Pacific coast, except at Los Angeles, California, where an excess of 0.21 occurs. Especially large deficiencies occur in Iowa, Florida, and along the Gulf coast. All stations in Arizona show an excess of rainfall, as well as several in the Ohio and Missouri valleys and in Tennessee.

In the following table are shown, for the several geographical districts, the normal precipitation for August; the average for August, 1886, and the excess or deficiency as compared with the normal:

Average precipitation for August.

Districts.	Average for August, Signal-Service observations.		Comparison of August, 1886, with the average for several years.
	For several years.	For 1886.	
	Inches.	Inches.	Inches.
New England	4.20	3.30	−0.90
Middle Atlantic States	4.70	3.88	−0.82
South Atlantic States	6.24	5.65	−0.59
Florida Peninsula	7.48	5.50	−1.98
Eastern Gulf States	5.49	4.12	−1.37
Western Gulf States	3.36	2.69	−0.67
Rio Grande Valley	4.32	1.86	−2.46
Tennessee	3.70	5.28	+1.58
Ohio Valley	3.59	3.70	+0.11
Lower lake region	3.64	3.49	−0.15
Upper lake region	3.27	3.68	+0.41
Extreme northwest	2.71	1.85	−0.86
Upper Mississippi Valley	3.50	2.90	−0.60
Missouri Valley	3.20	3.57	+0.37
Northern slope	1.37	0.79	−0.58
Middle slope	2.54	1.82	−0.72
Southern slope	4.00	2.68	−1.32
Southern plateau	2.80	3.50	+0.70
Middle plateau	0.46	0.30	−0.16
Northern plateau	0.15	0.11	−0.04
North Pacific coast region	0.61	0.15	−0.46
Middle Pacific coast region	0.02	trace	−0.02
South Pacific coast region	0.17	0.81	+0.64

The following are some of the most marked departures from the normal precipitation at Signal Service stations:

Above normal.		Below normal.	
	Inches.		Inches.
Norfolk, Virginia	4.58	Charleston, South Carolina	4.87
Rochester, New York	4.31	Sanford, Florida	4.08
Grand Haven, Michigan	3.57	New York City	3.91
Memphis, Tennessee	3.44	Des Moines, Iowa	3.75
Indianapolis, Indiana	3.42	Philadelphia, Pennsylvania	3.73
Fort Yates, Dakota	2.93	Wilmington, North Carolina	3.52
Keokuk, Iowa	2.81	Mobile, Alabama	3.46
Huron, Dakota	2.70	Rio Grande City, Texas	3.42

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows, for certain stations, as reported by voluntary observers, the average precipitation for the month of August for a series of years, the precipitation for August, 1886, and the departures from the average:

Station.	County.	Average precipitation for August.	Number of years.	Precipitation for August, 1886.	Departure.
Arkansas.		Inches.		Inches.	Inches.
Lead Hill	Boone	5.03	4	3.91	− 1.12
California.					
Sacramento	Sacramento	0.00	20	0.00	0.00
Connecticut.					
Canton *	Hartford	5.04	25	2.77	− 2.27
Hartford*	Hartford	4.46	15	2.12	− 2.34
Middletown *	Middlesex	4.95	28	3.23	− 1.72
New Haven *	New Haven	5.72	14	4.56	− 1.16
Wallingford *	New Haven	5.04	29	3.23	− 1.81
Dakota.					
Webster	Day	2.57	4	2.36	− 0.21
Illinois.					
Anna	Union	4.40	11	2.63	− 1.77
Mattoon	Coles	3.66	6	3.30	− 0.36
Peoria	Peoria	3.16	30	3.30	+ 0.14

Deviations from average precipitation—Continued.

Station.	County.	Average precipitation for June.	Number of years.	Precipitation for June, 1886.	Departure.
Illinois—Continued.		Inches.		Inches.	Inches.
Riley	McHenry	3.55	25	5.85	+ 2.30
Sycamore	De Kalb	3.68	5	4.29	+ 0.61
Indiana.					
Lafayette	Tippecanoe	2.84	7	4.46	+ 1.62
Logansport	Cass	3.34	31	6.30	+ 2.90
Spiceland	Henry	3.28	28	6.88	+ 3.60
Vevay	Switzerland	3.14	21	3.18	+ 0.04
Iowa.					
Monticello	Jones	3.92	33	2.38	− 1.54
Kansas.					
Atchison	Atchison	4.28	22	1.76	− 2.52
Independence	Montgomery	3.00	14	4.25	+ 1.25
Lawrence	Douglas	3.59	19	2.49	− 1.10
Wellington	Sumner	3.11	8	2.96	− 0.15
Yates Centre	Woodson	1.99	6	3.51	+ 1.52
Maine.					
Cornish	York	4.14	29	4.08	− 0.06
Gardiner	Kennebec	3.74	48	2.82	− 0.92
Orono *	Penobscot	3.16	18	2.27	− 0.89
Maryland.					
Fallston	Harford	5.20	15	4.53	− 0.67
Massachusetts.					
Amherst *	Hampshire	4.35	51	2.92	− 1.43
Cambridge *	Middlesex	4.68	45	2.80	− 1.88
Chestnut Hill *	Middlesex	3.52	11	3.52	0.00
Framingham *	Middlesex	3.86	12	3.79	− 0.07
Lake Cochituate *	Middlesex	5.00	35	3.75	− 1.25
Lynn *	Essex	3.80	12	3.59	− 0.21
Mystic Lake *	Middlesex	3.61	11	3.00	− 0.61
New Bedford *	Bristol	4.10	73	2.76	− 1.34
Somerset	Bristol	4.49	16	3.53	− 0.96
Springfield *	Hampden	4.49	39	3.31	− 1.18
Waltham *	Middlesex	4.42	62	2.78	− 1.64
Worcester *	Worcester	5.40	50	3.81	− 1.59
Nevada.					
Carson City	Ormsby	0.10	8	0.00	− 0.10
New Brunswick.					
Saint John *	Saint John	3.67	26	3.17	− 0.50
New Hampshire.					
Concord *	Merrimac	5.04	25	2.77	− 2.27
Hanover *	Grafton	2.87	21	2.25	− 0.62
New Jersey.					
South Orange	Essex	4.97	16	1.10	− 3.87
New York.					
Palermo	Oswego	2.24	33	2.30	+ 0.06
Plattsburg Barracks	Clinton	2.66	17	3.97	+ 1.31
Ohio.					
Wauseon	Fulton	2.90	14	4.86	+ 1.96
Westerville	Franklin	3.02	12	2.51	− 0.51
Pennsylvania.					
Dyberry	Wayne	3.33	15	1.98	− 1.35
South Carolina.					
Kirkwood	Kershaw	4.95	20	2.38	− 2.57
Stateburg	Sumter	3.33	6	2.12	− 1.21
Texas.					
New Ulm	Austin	3.12	15	4.64	+ 1.52
Vermont.					
Lunenburg *	Essex	3.70	38	4.70	+ 1.00
Newport *	Orleans	3.88	12	5.00	+ 1.12
Strafford *	Orange	3.60	12	3.20	− 0.40
Virginia.					
Bird's Nest	Northampton	4.20	18	6.20	+ 2.00
Dale Enterprise	Rockingham	4.60	6	5.85	+ 1.25
Variety Mills	Nelson	3 21	8	2.88	− 0.33
Wytheville	Wythe	3.75	22	4.78	+ 1.03
West Virginia.					
Helvetia	Randolph	4.48	10	3.77	− 0.71

* From the "Bulletin of the New England Meteorological Society."

The following notes, in connection with this subject, are from voluntary observers:

Illinois.—Sandwich, De Kalb county: the greatest August rainfall was that of 1862, 8.88; the least fell in 1881, 0.30.

Riley, McHenry county: the total rainfall of the summer of 1886, 8.55, is 3.13 less than the normal as deduced from the observations of twenty-five preceding summers; a smaller amount fell only during the summers of 1868, 1873, and 1883; 3.53 fell on the night of August 28–29th; until that date the rainfall of the present summer was the least.

Indiana.—Logansport, Cass county: the rainfall of August, 1876, 9.14, is greater than that of any August during the past thirty-one years; that of 1861, 0.17, is less.

Spiceland, Henry county: the rainfall for this month, 6.88, is greater than that of any August in the last twenty-eight years.

Vevay, Switzerland county: during the past twenty-one years large August rainfalls occurred in 1879, 10.90; 1876, 6.15; 1882, 5.99. Small rainfalls occurred in 1884, 0.54; 1881, 1.20.

Iowa.—Monticello, Jones county: the rainfall of August, 1885, 8.54, is the greatest, and that of August 1856, 1.17, is the least that has occurred in August during the past thirty-three years.

Kansas.—Lawrence, Douglas county: rain in measurable quantities fell on eleven days. There were six thunder showers. The entire rainfall for the eight months of 1886, now completed, has been 17.88, which is 7.43 below the average for the same months in the preceding eighteen years. The largest August rainfall in that time occurred in 1868, 8.32; the least in 1882, 0.09.

Yates Centre, Woodson county: the total rainfall of the summer of 1886, 10.67, is 0.51 below the normal.

Maine.—Cornish, York county: the rainfall of August, 1867, 9.00, is greater than that of any other August in the last twenty-nine years; that of 1876, 0.16, is less.

Maryland.—Fallston, Harford county: the rainfall of August, 1872, 11.15, is greater than that of any other August in the last fifteen years; that of 1881, 1.10, is less.

New Jersey.—South Orange, Essex county: the rainfall of the summer of 1886, 7.08, is 5.61 less than the average summer rainfall.

New York.—Palermo, Oswego county: during the past thirty-three years the largest August rainfall occurred in 1864, 6.40; the least, in 1870, 0.50.

Ohio.—Wauseon, Fulton county: the rainfall of the month, 4.86, is greater than that of any other August in the last fourteen years; the least fell in 1884, 1.12; the total rainfall of the summer, 7.18, is 4.49 less than the normal.

Westerville, Franklin county: in the past twelve years the greatest August rainfall occurred in 1880, 4.33; the least, in 1884, 1.07.

Pennsylvania.—Dyberry, Wayne county: in the past nineteen years the greatest August rainfall, 8.77, occurred in 1885; the least, 0.95, in 1883.

Texas.—New Ulm, Austin county: the largest rainfall in the past fifteen Augusts occurred in 1878, 8.38; the least in 1885, 0.09.

Virginia.—Wytheville, Wythe county: the total rainfall of the first eight months of 1886, 37.08, is 7.42 above the normal.

Variety Mills, Nelson county: the largest rainfall in the past nine Augusts, 7.29, occurred in 1879; the least, 0.57, in 1881.

MONTHLY SNOWFALLS.

The following monthly snowfalls have been reported:

Mount Washington, New Hampshire, on the 23d, 0.3 inch; Pike's Peak, Colorado, trace, on the 18th and 27th.

HAIL.

Miles City, Custer county, Montana: on the afternoon of the 5th a destructive thunder and hail storm occurred in the upper portion of the Yellowstone Valley. The rain and hail were unusually heavy. Crops over a strip of country six miles wide are reported to have been entirely destroyed. Near Merrill drifts of hail were found fourteen inches deep. In Park City windows and even roofs were destroyed.

Dakota, Stephenson county, Illinois: during the afternoon of the 5th a severe thunder-storm, attended by high wind and heavy hail, passed over this county. The wind damaged buildings and stripped trees of their fruit, while forest trees and growing corn were leveled to the ground. Considerable damage was done by hail throughout the surrounding country.

Janesville, Rock county, Wisconsin: a hail storm did great damage to growing tobacco on the afternoon of the 6th. Some fields north of the town were entirely destroyed.

Fort Yates, Dakota: on the 10th, between 8.55 and 10 p. m., a severe thunder-storm, attended by rain, hail, and high wind, prevailed here. During the storm the wind attained a maximum velocity of forty-five miles per hour from the southeast. The hail-stones were unusually large, ten, which were carefully measured by the observer, averaged three inches in diameter, the largest being three and a half. The stones were spherical in shape, with cylindrical protuberances, one-half to three-fourths of an inch long, projecting from their sides. Those that fell at the beginning of the storm were very hard on the outside but the centre consisted of dry compact snow. About 1,200 panes of glass were broken in the post and Indian agency buildings. The severity of the hail storm may be judged from the fact that all branches an inch thick or less were broken from cottonwood trees. During the storm a notable fall of temperature occurred, the temperature before the storm being 92°.0; after, 66°.0.

Hail was also reported to have fallen in the various states and territories, as follows:

Arizona.—Fort Verde, 12th; Fort McDowell, 30th.

Arkansas.—Fort Smith, 28th.

California.—Susanville, 30th.

Colorado.—Pike's Peak, 1st, 2d, 5th, 6th, 10th, 25th, 28th, 30th.

Dakota.—Fort Totten, 5th; Huron, 7th, 10th, 15th, 19th; Fort Yates, 13th, 15th.

Illinois.—South Evanston, 22d, 28th, 29th.

Indiana.—Logansport, 11th.

Iowa.—Cairo, 6th, 17th, 22d.

Kansas.—Salina, 5th, 31st.

Louisiana.—Liberty Hill, 25th.

Michigan.—Alpena, 13th; Mottville, 22d.

Minnesota.—Duluth, 11th.

Missouri.—Conception, 10th; Central College, 12th; Warrenton, 16th.

Montana.—Fort Missoula, 4th.

Table of excessive and greatest monthly precipitation for August, 1886.

Station.	Specially heavy.		Largest monthly.
	Date.	Amt.	Amount.
Alabama.			
Newton	29, 30	7.25	10.35
Valley Head	24	3.00	8.22
Eufaula	19	2.02	7.57
Greensborough	1, 2	2.19	7.31
Do	18	2.00	
Mt. Vernon B'ks	22, 23	4.64	6.90
Carrollton	23, 24	2.68	6.70
Oswichee	19	2.00	6.55
Selma	23, 24	2.74	6.54
Calera	2	2.01	6.32
Do	5	3.00	
Uni'sity of Ala'ma			6.07
Opelika	19, 20	2.17	
Montgomery	16	2.19	
Alaska.			
Sitka			10.72
Connecticut.			
New Haven	2	2.45	
Dakota.			
Yankton	8	2.53	
Huron	19, 20	2.49	
Florida.			
Manatee	12	2.00	11.43
Do	30, 31	2.20	
Fort Meade	7, 8	5.85	10 50
Live Oak	20	2.00	8.93
Limona	8	2.15	8.91
Do	30	2.30	
Pensacola	26	2.25	8.82
Do	30	3.07	
Tallahassee	1, 2	2.50	7.75
Do	26, 27	2.25	
Cedar Keys	27	2.84	7.08
Fort St. Augustine	29, 30	2.00	6.70
Jacksonville	26	2.95	6.25
Key West	6, 7	3.31	
Alva	8	3.25	
Sanford	7, 8	2.34	
Georgia.			
Jessup	26	2.70	9.97
Washington	18	4.25	7.60
Savannah			7.32
Toccoa	23	3.04	7.20
Columbia	20	3.29	6.49
Thomasville	19, 20	2.10	6.05
Milledgville	1, 2	3.37	
Illinois.			
Rockford	15	2.30	8.41
Do	28	5.32	
Riley	28, 29	3.33	
Indiana.			
Connersville	17	2.16	7.43
Sunman	16, 17	2.13	7.38
Do	28	2.10	
Mauzy	17	2.24	7.31
Spiceland	16	2.25	6.88
Indianapolis	6	2.11	6.70
Logansport	16	3.20	6.30
Butlerville			6.00
LaGrange	20, 21	2.00	
Monticello	29	2.81	
Iowa.			
Fort Madison	13	3.50	6.60
Keokuk	14	3.37	
Kansas.			
Yates Centre	3	2.62	
Independence	3	3.27	
Sterling	3	3.85	
Louisiana.			
Liberty Hill	25	2.96	
Maryland.			
Fallston	1	2.21	
Baltimore	7	2.21	
Massachusetts.			
Westborough	30, 31	2.25	
Michigan.			
Grand Haven	21, 22	4.07	6.57
Hudson	21, 22	2.25	
Kalamazoo	21, 22	3.08	
Marquette	22	2.16	
Lansing	28	2.88	
Pentwater	20, 21, 22	3.42	
Mississippi.			
Aberdeen			6.29
Brookhaven	1, 2	2.89	6.29
Hazelhurst	1, 2	3.03	
Holly Springs	1, 2	2.54	
Hernando	1, 2	3.10	
Missouri.			
Pierce City	3, 4	2.00	
Centreville	29	3.50	
Missouri—Con.			
Central College	18	2.21	
Lamar	3	3.08	
Nebraska.			
Stockham			6.75
New Hampshire.			
Mt. Washington	3, 4	2.62	8.34
New Jersey.			
Atlantic City	7	2.48	
Egg Harbor City	7	4.49	
Vineland	7	3.63	
New Mexico.			
Fort Union			8.04
New York.			
Rochester	30	3.34	7.26
Mountainville	1	2.00	
North Carolina.			
Goldsborough	15	2.12	14.25
Do	18, 19	5.50	
Lenoir	12, 13	2.50	10.20
Do	16, 17	2.90	
Chapel Hill	11	3.70	9.91
Hatteras	6, 7	2.15	9.74
Do	24	2.20	
New-Berne	15	2.00	8.96
Raleigh *a*	10, 11	3.04	8.19
Do	18, 19	2.25	
Lumberton	19	4.37	8.18
Kitty Hawk			7.34
Fort Macon			7.08
Raleigh *b*			6.90
Charlotte	6	3.19	6.34
Wadesborough			6.16
Statesville	18	2.21	
Ohio.			
Greenville	17	3.70	8.72
West Milton	11	2.00	7.75
Do	16	3.00	
Hanging Rock	22	3.00	6.29
Newcomerstown	14	2.78	6.06
College Hill	17	2.90	
Jacksonborough	16, 17	2.50	
Sidney	16	2.55	
North Lewisburg	15, 16	2.70	
Pennsylvania.			
Blooming Grove	1	3.00	
South Carolina.			
Allendale	2	2.30	8.36
Cheraw	18, 19	4.15	8.23
Spartanburg *a*			7.69
Greenville	28	2.03	7.38
Pacolet	9, 10	3.57	7.01
Saint George's	3, 4	2.86	6.77
Spartanburg *b*	10	2.60	6.07
Branchville	3, 4	2.31	
Florence	3	2.14	
Greenwood	18	2.03	
Anderson	18	2.00	
Yemassee	3, 4	2.95	
Aiken	27	2.30	
Tennessee.			
Riddleton	30	2.55	8.28
Memphis	1, 2	3.27	6.49
Do	28, 29	2.04	
Brownsville	1, 2	3.44	6.39
Austin			6.08
Grand Junction	1, 2	3.73	
Covington	1	2.02	
Fostoria	1	2.00	
Texas.			
Luling	30	4.60	6.30
Austin	20, 21	4.78	6.01
Dallas	30	3.07	
Weimar	20	2.17	
San Antonio	20	4.51	
Fort Concho	20	2.40	
Comfort	20, 21	3.10	
Virginia.			
Norfolk	12, 13	3.65	10.23
Do	17, 18	3.19	
Chincoteague	6, 7	3.50	6.71
Fort Monroe	17	2.40	6.33
Bird's Nest			6.20
Marion			6.09
Dale Enterprise	6, 7	2.60	
Wisconsin.			
Delevan	16	2.27	7.40
Do	28, 29	2.02	
Embarras	20, 21	4.45	7.00
Madison	16	3.35	
Wausau	20, 21	3.40	
Milwaukee	21, 22	2.40	
Fond du Lac	21	2.25	

Nebraska.—Hay Springs, 7th.
New Mexico.—Lava, 4th.
New York.—Palmyra, 2d; Rochester, 11th, 13th.
Pennsylvania.—Pittsburg, 11th.
South Carolina.—Spartanburg, 6th.
Tennessee.—Nashville, 6th.
Utah.—Frisco, 7th.
Wisconsin.—Delaware, 21st; Embarras, 26th.

SLEET.

Sleet occurred at Pike's Peak, Colorado, on the 3d, 4th, 7th, 8th, 15th, 16th, 17th, and 31st.

WINDS.

The most frequent directions of the wind during August, 1886, are shown on chart ii by the arrows flying with the wind; they are also given in the table of miscellaneous meteorological data. Along the Pacific coast the winds were mostly westerly; on the coast of the south Atlantic states the prevailing direction of the wind was from the southwest; in the west Gulf states the wind was generally from the southeast; in the Missouri Valley, from the south. In all other districts the wind was variable.

HIGH WINDS.

[*In miles per hour.*]

Wind-velocities of fifty or more miles per hour were recorded during the month, as follows:

Mount Washington, New Hampshire, 88, nw., 4th; 61, nw., 9th; 54, nw., 10th; 64, nw., 11th; 70, w., 12th; 59, sw., 13th; 80, nw., 14th; 80, nw., 15th; 62, s., 16th; 64, nw., 26th; 55, nw., 27th; 60, sw., 30th; 57, nw., 31st.
Fort Macon, North Carolina, 56, se., 6th.
Sandy Hook, New Jersey, 60, n., 7th.
Keokuk, Iowa, 60, nw., 12th.
Galveston, Texas, 53, ne., 20th.
San Antonio, Texas, 60, n., 20th.
Fort Totten, Dakota, 52, nw., 29th.

LOCAL STORMS AND TORNADOES.

Kalamazoo, Kalamazoo county, Michigan: a tornado is reported to have passed over parts of Kalamazoo and Barry counties at 10 a. m. of the 1st. Its course was marked by uprooted and twisted trees, unroofed barns, and prostrated windmills and fences. At the village of Hickory Corners a church steeple was blown down and many other buildings damaged. The storm was accompanied by heavy rainfall.

Hohokus, Bergen county, New Jersey: a heavy thunder and rain storm occurred at this place on the night of the 1st–2d. Shortly before midnight a high gale set in, blowing down a number of trees and destroying windows. One house was moved from its foundation and partly wrecked.

Hartland, Kearney county, Kansas: on the 5th a tornado passed over this place, demolishing twenty houses, as well as doing great damage to growing crops. Sixteen cars were blown from the Atchison, Topeka, and Santa Fé Railroad tracks, and two miles of telegraph wires west of the town were prostrated. Other towns in the vicinity of Hartland were visited by the tornado, but the damage done was slight.

Decatur, Illinois: on the afternoon of the 5th a severe thunder-storm, accompanied by high wind and hail, occurred in this section. The wind damaged buildings and stripped trees of their fruit, while large forest trees were uprooted and growing corn destroyed. Considerable damage was done by hail in the surrounding country. A heavy black cloud which preceded the storm presented the appearance of a tornado cloud, alarming the people, and causing many to seek security in cellars.

Cairo, Illinois: a very destructive storm of hail, rain, and wind occurred about 3 p. m. of the 6th at the town of Metropolis, twenty miles northeast of Cairo. Trees were uprooted, limbs torn off and carried at a rapid rate along the track of the storm, and fences, growing corn, and light buildings leveled to the ground. It is reported that hail fell to the depth of three inches and was still lying in heaps on the morning of the 7th.

Huron, Dakota: a heavy storm of rain and hail, followed by a destructive southwest gale, occurred here on the afternoon and evening of the 7th. The gale set in after the storm of hail and rain had passed, and continued only three minutes, overthrowing a number of small buildings and blowing down chimneys and fences. At the Dakota Agricultural Fair grounds the amphitheatre, grand stand, and several other structures were demolished, together with a great deal of the fencing, barns, and sheds. At the town of Newark, about one hundred miles north of here, five persons were killed and much property destroyed.

Frisco, Utah: a thunder-storm and heavy rain set in at 7.35 p. m. of the 7th. From 7.40 to 7.55 p. m. hail fell in considerable quantities. The storm did some damage by flooding cellars and undermining the trestle work of the railroad bridge near this place, rendering the passage of trains unsafe.

Aberdeen, Brown county, Dakota: on the night of the 10–11th a severe thunder-storm occurred in this town and vicinity. Northwest of this place the storm assumed the form of a tornado, destroying a farm house, several barns, and numerous grain-stacks in a track extending from ten miles west of Westport to Ordway. Another severe storm occurred here on the 16th.

Geneva, New York: between 6 and 7 p. m. of the 11th a very severe thunder-storm passed over this place. The storm was accompanied by heavy rain, hail, and wind. Many trees were uprooted and houses unroofed. The storm was also felt in Rochester, where the wind blew a gale. Much damage was done in the country by hail and in the city by overflowed sewers.

Pittsburg, Pennsylvania: a severe storm of wind and rain passed over this section at 10 p. m. of the 11th, doing a great deal of damage. Telegraph wires were blown down and several houses unroofed.

Akron, Summit county, Ohio: a destructive rain, wind, and thunder-storm occurred at this town on the night of the 11–12th. Numerous trees and fences were blown down and two houses wrecked. Fruit and other crops were destroyed in large quantities.

Keokuk, Iowa: at 3.45 p. m. of the 12th a thunder-storm and light rain began; at 3.52 p. m. the wind shifted to the northwest and a gale of sixty miles per hour and heavy rain set in. The wind decreased to brisk and veered to southeast at 4.45 p. m., the rain becoming light at the same time. The storm is estimated to have damaged property in this town to the extent of $15,000. A number of business houses were unroofed and a church spire blown down. The storm extended over this section of the state, and reports from numerous places in the surrounding country show that considerable damage was done to buildings and crops. The vicinity of the towns of Creston and Mount Pleasant suffered severe injury.

Saint Louis, Missouri: at 7 p. m. of the 12th the wind suddenly increased in velocity from fresh to a northwest gale, blowing for a time at the rate of forty-five miles per hour, and causing a sudden fall in temperature of 18°. At 7.30 p. m. a thunder-storm and light rain set in and continued until 10 p. m. The wind carried away one hundred and fifty feet of the woodwork of a large bridge in the city, and destroyed much corn in the country.

Cairo, Illinois: a thunder-storm and high wind occurred in this vicinity shortly after 11 p. m. of the 12th. Between 11 and 11.30 p. m. the wind attained a maximum velocity of thirty-eight miles per hour from the northwest. At Hannibal, Missouri, the storm was reported to have been very severe, blowing off roofs and injuring several persons.

Springfield, Illinois: a heavy thunder-storm and high wind prevailed at this place from 6.53 p. m. until midnight of the 12th. At 7.15 p. m. the wind attained a velocity of thirty-three miles per hour from the west. A number of signs, chimneys, and fences were blown down during the gale.

Chicago, Illinois: on the 12th the long drought was broken in southern Iowa and Illinois by a severe thunder-storm, accompanied by heavy rain and high wind. Numerous reports from

towns in Illinois and Iowa indicate that the storm was of great severity, the wind and rain combined doing great damage to trees and crops. The storm was especially destructive to the corn crop, as many acres were blown down. Although the wind was destructive to corn the heavy rain revived the grass and insured fall pasturage for stock.

Hannibal, Marion county, Missouri: on the afternoon of the 13th, after a warm day, highest temperature 100°, a heavy wind storm, succeeded by rain, set in. The roof of the Electric Light building was carried away, and numerous trees and light structures throughout the town were blown down.

Pekin, Tazewell county, Illinois: a heavy rain occurred here on the 13th, breaking the disastrous drought. The storm was accompanied by a gale of wind, blowing down trees and fencing. Reports from the surrounding country show that copious rain fell, doing great good to the corn crop, which had suffered severely from the drought. During the storm a large barn was struck by lightning and burned.

Philadelphia, Pennsylvania: on the 13th, between 3 and 4 p. m., an unusually severe thunder-storm and heavy rain occurred in the northern part of Berks and the southern part of Schuylkill counties, uprooting trees, blowing down sheds and light barns, as well as seriously injuring the corn and oat crop. The storm was most severe along the line of the Philadelphia and Reading Railroad, which was washed out in several places.

Evansville, Vanderburg county, Indiana: about 5 p. m. of the 14th a tornado passed over Newburg and other places in Warrick county, damaging property to a considerable extent. A flour mill was unroofed, and several dwellings blown down or injured by falling trees.

Saint Paul, Minnesota: heavy thunder-storms, accompanied by high wind, occurred in various places in Minnesota and Dakota on the afternoon of the 15th. At Elkton, Dakota, a railroad depot was unroofed and a church was blown from its foundation. At Larimore, Dakota, a church was also blown down. A number of frame houses were destroyed and several cars blown from the track at Dalton, Minnesota. At the same place twenty buildings were unroofed. Farmers also suffered considerable loss, their grain where standing being beaten to the ground and that in shock scattered.

Bismarck, Dakota: on the 15th, at 4.10 p. m., a thunder-storm began and continued until 7 p. m. The storm was accompanied by hail, which fell from 4.23 to 4.31 p. m., the stones being the size of marbles; also by high wind from the southwest. At 4.20 p. m. the wind suddenly shifted to the north, at the same time increasing in force until at 4.55 p. m. it had attained a velocity of forty-eight miles per hour. During the storm three houses were unroofed and several fences and sheds blown down by the wind, as was also numerous trees and telegraph poles.

Davenport, Iowa: on the 15th, at 4.32 p. m., a thunder-storm began, passing over the town from west to east. This storm after passing into Illinois developed into a tornado. At Cambridge, Henry county, Illinois, thirty miles southeast of Davenport, a heavy rain and wind storm passed over the town, blowing down the steeples of three churches and the town hall. The streets were blockaded with fallen trees and timber from houses. Considerable damage was done to crops.

Hamburg, Berks county, Pennsylvania: on the afternoon of the 16th a disastrous thunder and hail storm passed over this town and vicinity. Very heavy rain fell for two hours, badly washing the Philadelphia and Reading Railroad in several places. The corn and fruit crops were considerably injured by hail. Several barns in the adjacent country were struck by lightning and burned.

Cairo, Illinois: at 9.15 p. m. of the 17th a thunder-storm passed north of this city. Heavy thunder and vivid lightning continued during the night, but no rain fell. At Mound City the storm was quite destructive; a large furniture factory was unroofed and several buildings belonging to the Mound City Stave Company were badly damaged. A church, in which services were being held, was struck by lightning and several persons injured. The storm was accompanied by heavy rain and hail, the hail-stones being as large as hickory nuts. After the storm had subsided over two hundred sparrows were found under a large tree, killed either by lightning or hail. Along the line of the Illinois Central, and Cairo, Vincennes, and Chicago Railroads the storm was severe and destructive to property. At Centralia, Illinois, the wind moved with the velocity of a hurricane and was accompanied by heavy rain and hail. Throughout a belt of country two miles in width and many miles in length, numerous houses and barns were wrecked and streets blockaded with fallen trees. Hay-stacks, growing corn, and orchards laden with fruit were leveled to the ground, entailing a loss upon farmers of many thousands of dollars. At Carlyle, Tuscola, Mount Vernon, and various other places in Illinois, the destructive effects of the storm were severely felt by farmers, whose crops were destroyed and orchards blown down.

Washington, Wilkes county, Georgia: on the 18th a very severe thunder and hail storm occurred. The rainfall was heavy, 4.25 inches falling between 2.45 and 5 p. m. The storm was accompanied by high wind, which did considerable damage to farm property besides, carrying away the roof of a railroad depot.

Webster, Day county, Dakota: on the 21st this locality was visited by a gale which overturned and scattered stacks of hay and wheat as well as small buildings. The gale commenced at 12.30 p. m. and continued about an hour. Temperature before the storm, 103°; after the storm, 71°.

Rochester, New York: a severe thunder-storm began at 12.07 p. m. of the 30th; the storm was accompanied by heavy rain, 3.34 inches falling from 12.07 to 4.30 p. m., which is in excess of any rainfall that has occurred heretofore in this city in such a short time. In many sections the sewers were inadequate to carry off the water, and cellars were flooded, and considerable property injured.

TORNADO STUDIES FOR AUGUST, 1886.

[Prepared by Lieut. JNO. P. FINLEY, Signal Corps, U. S. Army, Assistant.]

In the study of tornadoes for the month of August, 1886, it has appeared desirable to prepare a chart (number viii) showing the relation of tornado centres to areas of barometric minima, selecting a day on which the conditions were fairly well shown.

In this connection it should be remembered that August is near the close of the tornado season, especially for the states in the Mississippi and Missouri valleys. As determined from the records of a long series of years, June is the month of greatest frequency, August standing sixth on the list, with considerably less than half as many storms.

Considering the tornado season by districts, it may be generally stated that in the south Atlantic and Gulf states they occur mostly from February 15th to April 15th; west of the Mississippi, from April 15th to June 15th; east of the Mississippi, from June 15th to August 15th; in the middle Atlantic states and New England, from July 15th to September 15th.

On chart number viii, which is the 3 p. m. (eastern time) tri-daily weather map of August 16th, the isobars are drawn for every tenth of an inch difference in pressure, and the isotherms for every difference of 10° in temperature. The words "High" and "Low," as used on the chart, indicate the centres of the regions of highest and lowest pressure, respectively. The location and direction of progressive movement of the tornadoes are shown by the following sign, $\times\times\times\times\longrightarrow$, placed upon the chart, and to the southeast of the centre of lowest pressure.

The tornadoes of August 16th occurred in Wyoming county, New York, between the hours of 3.30 and 4 p. m., local time, as will be seen by reference to the accompanying table.

These storms were associated with low-pressure area number vi, which was central on the afternoon of the 16th just north of Lake Erie; lowest barometer, 29.61, at Toronto, Canada. By reference to the chart, number viii, it will be seen that the

low-pressure area became extremely elongated to the northeast and southwest, with very high temperatures in the latter portion of the elliptical area. In Indian Territory, Kansas, and Missouri, the temperatures ranged from 95° to 104°. A small area of low pressure, 29.70, formed in northern Missouri, with fresh to brisk winds and high temperature gradients. Over a distance of about three hundred and fifty miles, in a line northwest and southeast, the temperature gradient was 35°, with opposing northerly and southerly winds.

Considering the principal area of low pressure, which was north of Lake Erie, we find the contrast in temperature gradient, with opposing easterly and westerly winds, to be 28° over a distance of about 280 miles in a line due north and south. In both cases the temperature gradient was about 7° per geographical mile. This was the result as determined along the line of maximum gradient in both areas of low pressure, treating them as separate centres of one elongated or trough-like depression. The average temperature gradient for each central area, as determined from four separate measurements, was found to be about 4°.5 per geographical mile in the Missouri depression and about 5°.4 per geographical mile in the Lake Erie depression.

The normal gradient, as determined from the 3 p. m. (eastern time) August temperature charts for several years, is found to be about 1°.9 per geographical mile for the region of the Lake Erie depression, and about 0°.94 per geographical mile for the region of the Missouri depression. From the above it is seen that the gradient of the former depression was about 3°.5 above the normal, and of the latter about 3°.56 above; this makes the temperature gradient in both regions practically the same, so far as the relation to the normal is concerned; while in the case of the average temperature gradient, the Lake Erie depression was 0°.90 per geographical mile higher than the Missouri depression.

The storm record for the 16th of August was considerably augmented by occurrences in other sections of the country, south and west of New York. From the extreme northwestern portion of West Virginia two heavy cloud-bursts were reported, together with violent winds, causing much destruction to life and property. In northern Indiana violent local storms occurred at, or near, Fountaintown, La Porte, Logansport, and Michigan City. In northern, western, and southern Missouri there were heavy winds and rain; also in northern Illinois with hail; in northern and central Ohio, and in extreme southern Michigan.

By reference to the table of thunder-storms it will be seen that the 16th of August was the great thunder-storm day of the month, a total of 298 storms being reported from the region embraced by the trough-like depression of low-pressure area vi.

By reference to chart number viii it will be seen that the tornado tracks are located to the southeast of the centre of lowest pressure, in what has been called the "dangerous octant" of an area of barometric minima. In this case the tornado centres are distant about 180 miles to the southeast. The direction of progressive movement of the area of low pressure during the afternoon of the 16th was about east-northeast, while the progressive motion of the tornado centres was due northeast, making an angle of about 30° with the former. In the Lake Erie depression the tornado centres lay east of the north and south line of maximum temperature gradient a distance of about 240 miles. In the Missouri depression the local storm-centres lay south and east of the line of maximum temperature gradient a distance of from 260 to 480 miles.

As has been enunciated in Professional Papers of the Signal Service number xvi, "Tornado Studies for 1884," there is a definite portion of an area of low pressure within which the conditions for the development of tornadoes is most favorable, and that portion is the southeast quadrant.

Report of tornadoes for the month of August, 1886, by Lieut. J. P. Finley, Signal Corps, U. S. Army, Assistant.

Place.	Date.	Time.	Direction.	Form of cloud.	Number of persons killed.	Number of persons wounded.	Width of path.	Number and kind of animals killed.	Number and kind of buildings destroyed.	Total valuation of property destroyed.	Authority.
Leipsic, Ohio *a*	1	2.30 p. m.	se.	Funnel							J. D. Hadermann.
Battle Creek, Michigan	1	10 a. m.							Several	Considerable.	"Evening News," Detroit, Michigan.
Hartland, Kansas	5	Evening.							20 houses	Great.	"Evening Star," Washington, D. C.
Beaudry, Minnesota *b*	9	2 45 p. m.	Easterly						Several buildings		J. T. Beaudry.
Near Aberdeen, Dakota	11	Early a. m							4 dwellings, 3 granaries, and 2 barns.	Considerable.	"Pioneer Press" of Saint Paul, Minnesota.
Attica, Indiana	12	8.15 p. m.							1 factory	$1,700	A. S. Peacock.
Newburg, Indiana	14	5 p. m.							2 houses destroyed and 1 mill damaged.	Great.	"Globe-Democrat" of Saint Louis, and "New York Herald."
Dalton, Albert Lea, and Breckenridge, Minnesota.	15	Between 7 and 10 p. m.				1			5 barns destroyed and many buildings damaged.	Considerable.	G. W. McMillen and "Daily Globe" and "Pioneer Press" of Saint Paul, Minnesota.
La Moure, Fort Abercrombie, Wild Rice, Hickson, Brampton, and Newark, Dakota. *c*	15	6.30 p. m.	ese.	Funnel	4	Many	2 miles	Several horses	1 hotel, 4 stores, 7 dwellings, 7 barns, 1 school, 1 church.	Great	T. E. Riggan, W. A Ellsworth, J. H. Ardly, G. W. McMillen, and W. H. Atwater, and "Daily Globe" of Saint Paul, Minnesota.
Wyoming, Warsaw, Martinsville, and Castile, New York *d*	16	3.30 to 4 p. m.	ne.	Funnel					Several buildings damaged.	Considerable.	W. E. Cushing and "Democrat Review," "Wyoming County Times," and "Western New Yorker," New York.
Agency, Missouri *e*	17	6 p. m.	e.						Several buildings damaged.		Thos. B. Best.
Elmont, Texas *f*	18	3.30 p. m.								Small.	W. A. Rexroat.
Buffalo, Cochran's Mills, Cokato, and Keystone, Minnesota. *g*	21	5 p. m.	ne. ?	Funnel					1 house, etc	Considerable.	C. K. Dodd, M. V. Cochran, and Axle Jorgenson.
Enderly, Minnesota *h*	21	4.20 p. m.	ne. ?						A number of buildings damaged.	Considerable.	Edward Lewis.
Lyons Station, Connersville, and Quakertown, Indiana. *i*	22	3.25 to 6 p. m.	se.	Funnel			200 yards		1 barn damaged, etc		J. V. Lyons, R. Kessler, and the postmaster at Quakertown, Indiana.
San Antonio and Comanche, Texas.	24	5 p. m.	se.	Funnel					4 buildings damaged.		Aug. Holzapfel, E. N. Wiesendanger, and newspaper clippings.

a Funnel-shaped cloud swaying to and fro.

b Clouds were black, running fast, with little cloud amongst them turning around.

c Heavy timbers carried long distances; a two-inch plank was carried through the air and forced through a roof.

d Two dark clouds were passing each other, one from the sw. and the other from the nw.; as they collided they moved due n.

e In some places the débris showed pressure on ground, in some places straight wind, and in some places a circular effect was shown.

f A small cloud formed in se., and all surrounding clouds seemed to gather to it. It was only about thirty minutes from the time it formed until it struck the ground about one and a fourth miles se. of Elmont, moving gin house six inches.

g A light cloud, with slow motion, coming from the w., with a black cloud below, with tremendous swift motion.

h At base of main cloud there arose a dense mass of cloud, in color and appearance like escaped steam from a large engine, which went rushing s. with a speed of eighty miles and upward per hour, sweeping everything in its way.

i Tornado cloud in commotion, swaying from side to side.

Table of miscellaneous meteorological data for August, 1886—Signal Service observations.

Stations.	Elevation above sea-level.	Atmospheric pressure (in inches and hundredths). Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes. Highest barometer	Date.	Lowest barometer	Date.	Monthly range of barometer.	Temperature of the air (in degrees Fahrenheit). Monthly mean.	Departure from normal.	Extremes. Max.	Date.	Mean max	Min.	Date.	Mean min.	Monthly range.	Daily ranges. Greatest.	Date.	Least.	Date.	Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Winds. Total movement.	Prevailing direction.	Maximum velocity. Miles p. h.	Direction.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.
New England.																																			
Eastport	61	29.86	—.05	29.93	30.35	20	29.37	3	0.99	59.2	— 1.5	81.6	28	67.2	47.0	20	52.3	34.6	28.8	9	3.1	30	84.1	54.0	2.41	— 0.93	3,993	s.	25	ne.	17	9	2	13	16
Portland	99	29.83	—.05	29.93	30.36	20	29.44	2	0.92	64.7	— 3.0	87.0	11	73.7	49.3	18	57.1	37.7	28.6	26	5.8	7	74.5	55.4	3.93	+ 0.38	4,561	nw.	22	s.	13	9	3	15	13
Mount Washington	6,279	23.87	......	29.90	30.46	20	29.41	2	1.04	46.8	— 0.3	68.9	27	53.7	28.3	15	41.0	40.6	25.2	2	4.2	4	86.4	42.0	8.34	+ 0.24	20,750	nw.	88	nw.	4	14	2	20	9
Boston	125	29.82	—.06	29.95	30.36	20	29.47	2	0.90	67.7	— 1.6	90.4	27	76.8	49.3	23	59.7	41.1	32.0	23	7.3	25	71.7	57.3	3.64	— 0.95	7,152	w.	34	w.	3	12	3	15	13
Block Island	27	29.94	......	29.96	30.35	20	29.51	2	0.84	67.2	— 1.3	80.0	12	72.9	54.5	23	62.0	25.5	17.3	16	5.3	25	88.7	63.7	2.47	— 0.94	8,366	sw.	40	ne.	25	10	3	13	15
Narragansett Pier	...	...	...	...	...	...	...	...	...	67.4	......	85.0	12	76.0	45.0	23	58.8	40.0	...	...	...	...	...	...	3.51	— 0.35	...	...	...	...	...	9	...	...	...
New Haven	107	29.86	......	29.96	30.35	20	29.54	2	0.81	68.2	— 2.0	85.6	14	78.1	47.8	22	59.5	37.8	29.5	22	8.2	31	76.9	59.9	4.56	— 1.25	4,167	s.	24	n.	7	11	6	15	10
New London	47	29.94	—.05	29.98	30.37	20	29.55	2	0.82	67.9	— 1.9	83.7	12	75.6	49.8	22	60.7	33.9	25.7	22	5.4	1	79.8	61.0	5.04	— 0.32	4,149	nw.	27	sw.	17	11	4	19	8
Mid. Atlantic States.																																			
Albany	83	29.89	—.05	29.97	30.36	20	29.59	2	0.77	70.3	— 0.3	92.7	29	81.6	52.0	3	59.5	40.7	32.5	29	13.1	30	65.4	56.8	0.87	— 2.83	3,684	s.	31	s.	29	8	5	13	13
New York City	168	29.82	—.05	29.98	30.34	9	29.61	2	0.73	71.0	— 1.1	87.7	28	79.3	57.8	3	64.9	29.9	24.1	5	6.8	7	71.5	60.6	1.18	— 3.91	5,064	s.	24	nw.	3	6	3	14	14
Philadelphia	117	29.87	—.05	29.98	30.35	9	29.63	2	0.72	73.2	— 0.5	91.8	29	82.5	56.1	22	66.2	35.7	24.6	22	4.4	7	76.8	64.8	1.38	— 3.73	5,711	s.	36	nw.	14	6	7	13	11
Atlantic City	13	29.95	—.07	29.95	30.31	9	29.58	2	0.73	71.4	— 0.6	86.5	2	77.6	55.3	3	65.1	31.2	18.9	4	6.9	19	84.3	66.1	3.58	— 1.49	5,410	sw.	37	ne.	7	11	8	11	12
Sandy Hook	28	29.93	—.08	29.95	30.31	20	29.58	2	0.73	71.8	— 0.9	89.2	28	79.1	59.8	22	66.0	29.4	20.2	26	3.0	7	78.1	64.2	2.75	— 2.02	9,441	sw.	60	n.	7	7	5	11	15
Cape Henlopen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Baltimore	45	29.94	—.05	29.98	30.33	9	29.67	2	0.67	73.5	— 1.8	91.0	27	82.0	58.1	22	66.6	33.9	20.6	5	8.3	7	72.0	63.2	3.94	— 0.55	3,680	nw.	17	w.	30	8	6	13	12
Ocean City	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Washington City	106	29.88	—.06	29.98	30.33	9	29.69	30	0.64	73.1	— 1.6	92.0	27	81.9	55.8	23	64.8	36.2	23.4	5	6.9	7	75.0	63.9	2.43	— 2.37	3,371	s.	16	nw.	2	9	6	12	13
Cape Henry	16	29.97	—.05	29.97	30.29	9	29.69	2	0.60	74.1	— 2.2	90.8	17	79.0	64.8	5	70.2	26.0	17.7	17	3.5	19	83.2	68.4	5.27	+ 0.33	9,439	ne.	44	ne.	24	15	8	14	9
Chincoteague	8	29.98	—.05	29.97	30.31	9	29.63	2	0.68	73.2	— 0.2	87.2	12	78.2	59.0	6	67.6	28.2	16.5	27	6.1	31	82.1	67.0	6.71	+ 2.76	6,906	s.	37	ne.	24	10	6	17	8
Lynchburg	652	29.92	—.04	29.99	30.31	9	29.68	30	0.63	73.8	— 1.8	91.8	27	84.2	57.3	21	65.7	34.5	25.6	25	11.2	7	82.5	67.3	4.29	+ 0.18	1,816	ne.	14	ne.	15	14	9	16	6
Norfolk	30	29.96	—.05	29.97	30.30	9	29.69	2	0.61	74.5	— 2.6	92.8	17	82.7	64.4	5	69.2	28.4	21.0	12	5.6	24	81.5	67.9	10.23	+ 4.58	3,280	ne.	23	n.	24	17	13	12	6
South Atlantic States.																																			
Charlotte	808	29.18	—.02	29.99	30.26	9	29.68	30	0.57	75.1	— 1.2	91.9	26	85.5	56.4	21	65.5	35.5	25.6	12	10.8	10	84.8	69.7	6.34	+ 1.76	3,101	sw.	26	nw.	12	15	12	17	2
Fort Macon	11	29.99	—.03	29.97	30.28	9	29.60	24	0.68	76.5	— 1.4	86.5	23	81.4	64.9	22	72.5	21.6	19.4	23	5.0	24	87.3	72.3	7.08	+ 0.60	11,174	sw.	56	se.	6	17	10	17	4
Hatteras	12	29.99	—.03	29.98	30.31	9	29.61	21	0.70	75.5	— 2.0	84.3	1	80.1	65.5	4	71.5	18.8	12.3	5	4.0	22	87.1	71.1	9.74	+ 3.53	7,140	sw.	36	ne.	24	18	6	19	6
Kitty Hawk	9	29.99	—.05	29.98	30.32	9	29.63	24	0.69	74.9	— 1.9	90.5	17	79.8	65.6	3	70.7	24.9	19.7	12	2.6	21	83.0	69.0	7.34	— 0.15	10,659	ne.	44	ne.	24	17	10	15	6
New River Inlet	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Smithville	34	29.95	—.05	29.96	30.24	10	29.73	31	0.51	77.4	— 1.9	87.0	17	82.2	58.8	22	71.1	28.2	20.8	22	5.5	6	86.7	72.9	3.36	— 2.19	7,624	sw.	28	sw.	1	16	12	13	6
Wash Woods	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wilmington	52	29.94	—.04	29.97	30.25	9	29.72	2	0.53	77.0	— 1.5	92.8	12	85.5	60.2	22	70.5	32.6	21.9	25	7.0	6	82.2	70.7	4.38	— 3.52	4,517	sw.	20	w.	2	16	10	14	7
Charleston	52	29.95	—.03	29.97	30.18	9	29.73	30	0.46	77.4	— 3.3	92.0	13	85.3	66.2	23	73.3	25.8	15.9	23	6.9	4	2.4	72.2	3.28	— 4.87	5,313	sw.	21	ne.	9	13	10	10	11
Augusta	183	29.82	—.04	29.98	30.18	20	29.68	30	0.50	77.6	— 2.0	100.6	15	89.5	60.7	22	69.4	39.9	28.1	14	6.1	9	79.9	69.9	2.29	— 2.45	2,515	se.	16	sw.	1	9	8	14	9
Savannah	87	29.92	—.03	29.97	30.20	10	29.72	31	0.47	79.9	— 0.7	93.2	1	86.8	65.8	22	74.4	27.4	18.0	24	8.0	6	83.0	73.8	7.32	— 0.80	4,637	sw.	32	ne.	9	16	8	17	6
Jacksonville	43	29.97	—.02	29.98	30.20	10	29.73	23	0.42	80.4	— 0.5	93.8	14	88.8	64.9	23	74.5	28.9	19.2	12	6.8	30	81.5	73.7	6.25	— 0.83	4,092	se.	25	sw.	3	15	7	18	6
Florida Peninsula.																																			
Cedar Keys	22	30.01	+.01	29.99	30.19	10	29.81	23	0.38	80.8	— 1.0	92.7	18	87.0	68.7	23	75.0	24.0	20.4	13	5.8	2	79.7	73.5	7.08	— 2.49	6,136	sw.	32	w.	30	12	11	14	6
Key West	20	29.97	—.03	29.94	30.12	9	29.68	17	0.44	84.9	+ 0.6	100.0	4	91.4	73.1	6	79.2	26.9	19.2	24	6.9	11	74.5	75.6	4.54	— 0.53	8,488	e.	40	e.	18	14	6	20	5
Sanford	25	29.96	......	29.94	30.15	10	29.73	23	0.42	79.6	— 0.6	94.4	1	88.7	67.9	24	73.1	26.5	20.2	24	7.4	31	81.3	72.9	4.12	— 4.08	4,406	ne.	26	ne.	20	15	7	12	12
Eastern Gulf States.																																			
Atlanta	1,129	28.86	—.03	29.99	30.21	10	29.70	30	0.51	76.1	+ 0.5	94.0	15	85.7	62.0	21	68.8	32.0	21.4	22	8.0	5	78.7	68.2	2.36	— 1.93	5,241	nw.	26	nw.	1	11	3	18	10
Pensacola	30	29.94	—.04	29.93	30.15	10	29.70	30	0.45	80.9	+ 0.5	95.6	15	88.8	70.3	24	75.5	25.3	18.6	13	5.8	1	80.0	73.8	8.82	— 1.87	4,862	sw.	24	s.	26	15	5	17	9
Mobile	35	29.95	—.03	29.95	30.17	10	29.74	30	0.43	79.9	— 0.8	97.0	15	89.0	67.4	22	73.3	29.6	24.0	15	9.5	1	76.9	71.2	3.55	— 3.46	4,670	nw.	28	nw.	23	12	2	21	8
Montgomery	219	29.76	—.04	29.96	30.20	10	29.71	30	0.49	80.0	— 0.1	97.8	16	89.9	66.4	22	72.8	31.4	25.7	16	7.4	2	75.3	70.7	5.37	+ 1.97	3,172	se.	20	w.	5	11	6	19	6
Vicksburg	222	29.76	—.05	29.96	30.16	10	29.75	29	0.41	80.4	0.0	96.3	18	90.7	66.1	31	72.3	30.2	22.8	9	8.1	2	76.0	71.3	2.42	— 0.85	3,280	se.	24	s.	5	9	1	15	15
New Orleans	52	29.92	—.03	29.94	30.14	10	29.76	29	0.37	81.4	— 0.5	94.7	16	89.9	67.8	24	75.6	26.9	21.2	24	6.7	3	77.3	72.9	2.40	— 3.13	4,399	sw.	23	nw.	6	13	1	19	11
Western Gulf States.																																			
Shreveport	227	29.74	—.04	29.94	30.12	10	29.74	29	0.39	82.0	0.0	101.0	17	95.7	63.8	26	73.4	37.2	27.6	26	13.1	6	73.4	71.5	3.60	+ 1.67	3,003	se.	19	w.	29	5	0	8	23
Fort Smith	470	29.45	—.08	29.89	30.07	10	29.69	29	0.37	79.0	+ 2.2	104.5	18	91.5	57.1	31	70.4	47.4	30.6	18	5.7	4	74.8	68.9	1.82	— 0.53	2,466	e.	12	n.	1	8	4	11	16
Little Rock	288	29.64	—.04	29.91	30.08	10	29.67	29	0.41	79.2	+ 0.9	97.8	17	89.4	62.5	31	71.6	35.3	22.9	6	9.5	4	77.0	70.3	5.31	+ 1.73	3,015	e.	24	nw.	6	8	4	15	12
Galveston	40	29.94	—.02	29.94	30.09	10	29.67	20	0.42	83.2	— 0.4	94.4	23	88.9	71.3	28	78.6	23.1	15.8	23	6.4	3	76.0	74.6	2.46	— 2.65	6,945	se.	53	ne.	20	7	2	13	16
Indianola	26	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Palestine	533	29.44	—.05	29.96	30.12	10	29.76	29	0.37	81.2	+ 1.4	98.2	15	93.3	65.4	26	72.9	32.8	26.0	26	12.1	6	69.4	68.6	1.32	— 0.71	5,435	s.	39	sw.	12	6	2	13	16
San Antonio	781	29.13	......	29.89	30.09	10	28.67	20	1.41	82.7	+ 0.6	100.2	24	94.9	*70.0	29	*73.0	†	27.2	24	10.3	20	67.0	68.8	4.79	+ 1.51	4,287	se.	60	n.	30	5	4	20	7
Rio Grande Valley.																																			
Brownsville	57	29.88	—.07	29.89	30.05	10	29.63	20	0.42	81.1	— 1.8	98.1	7	91.5	70.4	24	73.8	27.7	24.0	24	13.2	12	84.8	75.4	3.08	— 1.51	4,768	se.	19	s.	3	4	2	9	20
Rio Grande City	230	29.72	—.05	29.92	30.09	10	29.70	20	0.38	85.6	+ 2.1	103.2	7	99.5	73.2	11	76.3	30.0	28.0	19	12.6	28	64.1	70.0	0.63	— 3.42	4,908	se.	19	se.	1	5	2	11	18
Ohio Val. & Tenn.																																			
Chattanooga	783	29.21	—.03	29.99	30.22	10	29.72	23	0.51	75.5	0.0	97.4	17	86.1	61.8	7	68.1	35.6	26.9	16	6.4	30	76.8	66.9	3.96	— 0.27	3,257	w.	29	ne.	17	10	8	13	10
Knoxville	980	29.01	—.02	30.01	30.24	10	29.77	23	0.48	74.8	+ 0.1	93.2	17	84.9	58.2	18	65.7	35.0	26.2	17	7.2	5	80.6	67.8	5.17	+ 0.92	2,627	ne.	32	n.	17	13	7	16	8
Memphis	320	29.65	—.04	29.96	30.15	10	29.71	29	0.44	78.8	— 0.3	97.8	17	88.2	60.4	31	71.6	37.4	21.6	9	6.7	1	74.0	6[illegible].7	6.49	+ 3.44	4,041	nw.	24	ne.	22	12	3	13	15
Nashville	549	29.41	—.01	29.96	30.19	10	29.73	29	0.46	75.6	— 2.5	97.7	17	86.5	58.7	8	67.7	39.0	27.2	26	6.7	21	76.7	66.7	5.50	+ 2.24	3,643	ne.	37	nw.	22	15	5	20	6
Louisville	551	29.41	—.03	29.97	30.20	9	29.70	29	0.50	75.3	— 1.0	94.5	16	86.4	59.1	31	67.3	35.4	26.1	9	9.7	23	70.4	63.8	4.43	+ 0.91	3,812	n.	32	w.	13	13	4	18	9
Greencastle	897	29.05	......	29.97	30.20	19	29.68	29	0.51	72.8	......	92.5	16	82.5	53.9	31	66.0	38.6	24.5	7	8.8	30	76.9	64.5	4.53	......	3,227	s.	31	w.	16	13	5	15	11
Indianapolis	766	29.19	—.04	29.98	30.21	19	29.69	29	0.52	72.9	— 1.0	92.2	11	84.1	53.0	31	64.0	39.2	28.3	20	10.5	30	72.1	62.2	6.70	+ 3.42	3,028	s.	32	nw.	22	13	8	12	11
Cincinnati	628	29.34	—.04	29.98	30.23	9	29.71	29	0.52	73.9	— 1.6	90.8	11	83.2	56.9	3	65.9	33.9	23.7	8	7.0	23	72.2	63.5	2.91	— 1.17	3,972	e.	44	ne.	22	13	5	14	12
Columbus	811	29.14	—.04	29.98	30.25	9	29.69	29	0.56	71.5	— 0.7	90.6	11	81.8	51.0	3	61.4	39.6	30.4	8	10.5	30	73.3	61.6	2.44	— 1.43	3,955	sw.	34	nw.	22	9	5	16	10
Pittsburg	766	29.18	—.05	29.97	30.28	9	29.66	30	0.62	72.1	+ 0.3	92.6	28	83.6	51.8	4	63.9	40.8	27.2	5	11.2	7	76.6	63.7	2.85	— 0.48	3,421	nw.	28	sw.	16	9	9	13	9
Lower lake region.																																			
Buffalo	690	29.25	—.03	29.98	30.29	19	29.63	16	0.66	67.5	— 1.5	86.2	28	74.8	47.2	6	59.6	39.0	28.0	6	7.2	17	72.7	57.7	2.77	— 0.65	5,709	s.	28	s.	14	10	5	14	12
Oswego	335	29.60	—.06	29.96	30.28	20	29.65	30	0.62	66.3	— 2.9	89.0	29	74.4	48.2	6	58.9	40.8	30.6	13	4.5	24	74.9	57.5	2.58	+ 0.14	6,418	s.	30	nw.	3	7	7	16	8
Rochester	621	29.32	—.05	29.97	30.28	19	29.66	16	0.62	66.8	— 2.1	91.4	29	79.2	47.0	6	58.2	44.4	34.5	13	7.2	24	78.6	59.5	7.26	+ 4.31	6,547	sw.	34	w.	3	8	7	14	10
Erie	681	29.26	—.04	29.97	30.26	19	29.66	30	0.60	68.4	— 1.6	85.8	1	77.0	50.7	4	61.0	35.1	24.6	20	8.5	24	70.0	57.7	1.53	— 1.80	5,582	s.	24	nw.	3	9	6	12	13
Cleveland	690	29.25	—.05	29.97	30.24	19	29.68	29	0.56	69.5	— 0.5	89.5	29	77.8	51.0	4	61.5	38.5	25.7	20	7.9	14	73.3	59.9	1.36	— 2.05	5,575	ne.	32	w.	16	10	7	11	13
Sandusky	638	29.32	—.03	29.99	30.27	19	29.68	29	0.59	70.3	— 1.2	90.0	11	79.7	52.7	31	63.5	37.3	25.7	9	5.8	14	74.4	61.0	3.78	— 0.25	7,312	sw.	36	n.	2	12	7	15	9
Toledo	651	29.31	—.01	30.00	30.29	19	29.68	29	0.60	69.3	......	92.5	11	79.7	49.5	3	61.5	43.0	25.9	8	7.2	14	72.1	58.9	3.13	+ 0.18	4,841	ne.	26	w.	10	11	6	17	8
Detroit	662	29.28	—.04	29.97	30.28	19	29.66	29	0.62	70.2	+ 0.2	89.3	11	78.3	51.5	3	63.0	37.8	23.5	3	7.6	21	74.6	61.2	2.02	— 0.96	5,618	sw.	26	sw.	16	9	6	15	10
Upper lake region.																																			
Alpena	609	29.31	—.04	29.96	30.26	19	29.64	29	0.63	62.8	— 1.2	90.3	27	72.2	44.0	4	55.4	46.3	33.6	8	5.0	20	82.2	56.7	3.48	— 0.26	5,583	se.	40	nw.	13	13	9	11	11
Escanaba	608	29.29	—.04	29.95	30.26	18	29.64	29	0.62	62.8	— 1.9	80.0	27	70.4	41.6	31	54.7	38.4	25.7	3	2.9	20	78.9	55.7	4.38	+ 0.19	5,352	sw.	20	ne.	1	9	7	11	13
Grand Haven	620	29.30	—.05	29.95	30.25	19	29.63	16	0.62	67.1	— 0.7	86.0	12	76.2	46.3	3	59.8	39.7	28.0	12	6.5	30	76.2	58.7	6.57	+ 3.57	6,165	s.	28	e.	29	6	5	14	12
Mackinaw City	605	29.29	—.05	29.94	30.23	19	29.61	29	0.62	63.6	+ 2.4	92.5	9	71.6	45.8	18	56.3	46.7	28.5	8	4.8	22	76.8	55.6	3.25	+ 0.58	5,616	w.	24	w.	31	9	5	9	17
Marquette	672	29.22	—.05	29.95	30.26	18	29.62	29	0.62	62.8	— 1.7	97.7	9	72.3	41.8	3	54.3	55.9	35.6	9	6.1	20	75.3	54.3	3.70	+ 0.60	5,922	nw.	25	w.	26	12	7	16	8
Port Huron	633	29.31	—.02	29.98	30.30	19	29.64	30	0.65	66.4	— 1.0	87.1	27	75.5	44.7	3	58.9	42.4	25.2	26	3.3	24	78.1	58.8	2.73	— 0.14	5,404	ne.	26	sw.	10	11	6	11	14
Chicago	661	29.27	—.04	29.96	30.22	19	29.66	29	0.56	72.4	+ 1.0	91.6	21	78.7	53.0	31	66.5	38.6	23.2	16	4.2	18	72.8	62.5	3.38	+ 0.15	5,432	e.	24	nw.	16	11	4	19	8
Milwaukee	697	29.20	—.08	29.93	30.21	19	29.62	29	0.59	67.9	— 0.5	92.7	9	75.6	47.8	31	62.6	44.9	25.7	9	6.5	17	76.3	59.6	3.40	+ 0.30	6,609	ne.	29	w.	21	8	6	15	10
Duluth	672	29.21	—.05	29.94	30.28	18	29.66	29	0.62	63.9	— 1.6	92.1	26	72.6	40.5	31	56.8	51.6	33.2	7	4.8	17	72.5	53.5	2.23	— 1.26	4,453	ne.	28	nw.	9	10	2	13	16
Extreme northwest.																																			
Moorhead	923	28.92	—.06	29.91	30.20	18	29.66	12	0.54	66.8	+ 1.8	100.1	24	81.1	31.9	31	54.3	68.2	42.2	7	13.0	27	71.1	55.5	1.32	— 2.52	6,229	s.	36	sw.	9	6	2	16	13
Saint Vincent	804	29.05	—.06	29.93	30.23	2	29.62	19	0.61	64.2	+ 1.9	103.2	24	79.7	33.0	31	50.9	70.2	44.2	24	12.1	30	81.0	57.7	0.41	— 2.72	5,873	n.	39	nw.	30	4	1	13	17
Bismarck	1,694	28.13	—.04	29.92	30.16	2	29.64	25	0.52	69.6	+ 2.3	104.4	24	83.3	33.9	31	57.7	70.5	36.9	31	13.1	2	57.9	51.4	1.45	— 1.26	5,530	s.	48	n.	15	11	3	17	11
Fort Buford	1,854	27.91	—.04	29.85	30.14	17	29.55	24	0.59	68.6	+ 2.6	103.9	22	84.5	34.5	31	56.1	69.4	40.5	31	10.5	2	50.9	46.1	0.87	— 0.32	6,228	ne.	40	w.	29	4	3	17	11
Fort Totten	1,487	28.34	......	29.93	30.22	2	29.65	19	0.58	66.7	......	103.0	24	80.1	29.2	31	52.8	73.8	39.2	24	13.2	2	69.6	55.3	1.06	......	7,973	ne.	52	nw.	29	10	0	16	15
Fort Yates	...	...	...	...	...	...	...	...	...	72.4	......	104.2	24	86.3	31.7	31	58.4	72.5	...	...	...	...	...	...	4.83	...	...	...	...	...	...	10	...	...	...

Table of miscellaneous meteorological data for August, 1886—Signal Service observations—Continued.

Stations.	Elevation above sea-level.	Atmospheric pressure (in inches and hundredths). Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes. Highest barometer	Date.	Lowest barometer	Date.	Monthly range of barometer.	Temperature of the air (in degrees Fahrenheit). Monthly mean.	Departure from normal.	Extremes. Max.	Date.	Mean max	Min.	Date.	Mean min.	Monthly range.	Daily ranges. Greatest.	Date.	Least.	Date.	Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Winds. Total movement.	Prevailing direction.	Maximum velocity. Miles p. h.	Direction.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.
Upper Miss. Valley.																																			
Saint Paul	831	29.05	—.04	29.93	30.22	18	29.69	12	0.52	69.6	+ 0.2	94.2	12	82.3	42.1	31	59.7	52.1	37.0	7	9.3	28	69.8	58.0	2.27	— 1.49	4,842	nw.	31	w.	21	8	2	16	13
La Crosse	725	29.20	—.02	29.96	30.21	18	29.72	16	0.49	73.0	+ 2.2	91.3	27	82.3	48.8	31	64.6	42.5	26.2	8	9.6	28	79.2	65.9	3.90	+ 0.25	4,465	s.	36	nw.	21	7	2	18	11
Davenport	615	29.30	—.06	29.94	30.17	19	29.66	29	0.51	74.4	+ 1.5	96.8	12	85.6	49.2	31	65.1	47.6	30.8	12	13.0	17	67.0	61.4	2.67	— 1.54	4,582	e.	32	sw.	12	9	10	8	13
Des Moines	849	29.06	—.07	29.93	30.13	31	29.65	15	0.48	76.8	+ 4.3	101.6	24	90.1	46.0	31	67.0	55.6	35.1	7	14.0	13	67.2	63.8	1.10	— 3.75	3,176	sw.	24	nw.	12	9	11	9	11
Dubuque	665	29.24	...	29.94	30.18	19	29.69	13	0.49	74.1	+ 2.5	97.4	21	85.9	45.5	31	63.8	51.9	34.0	8	8.2	4	65.3	60.3	0.67	— 3.18	3,261	s.	18	s.	20	9	7	14	10
Keokuk	618	29.29	—.06	29.93	30.13	19	29.71	10	0.42	77.1	+ 2.2	99.1	12	88.1	53.4	31	67.8	45.7	30.1	8	12.8	23	64.2	62.7	5.90	+ 2.81	5,273	s.	60	nw.	12	10	3	10	18
Cairo	359	29.61	—.03	29.97	30.17	10	29.73	29	0.44	76.8	— 0.9	97.0	17	85.8	57.8	31	69.6	39.2	25.7	20	9.6	1	76.3	67.8	2.84	+ 0.09	4,308	s.	38	nw.	13	10	2	23	6
Springfield	644	29.31	—.05	29.97	30.19	19	29.73	29	0.46	76.1	+ 2.5	99.4	16	85.9	54.4	31	67.2	45.0	27.2	8	7.9	29	69.7	64.7	4.19	+ 1.32	4,606	s.	33	w.	12	10	1	16	14
Saint Louis	571	29.34	—.06	29.95	30.15	9	29.72	29	0.43	79.9	+ 3.3	102.0	16	88.5	61.0	31	70.4	41.0	26.3	28	10.6	30	59.8	63.5	2.44	— 0.06	6,945	sw.	46	sw.	12	9	2	19	10
Missouri Valley.																																			
Lamar	1,028	28.96	...	29.96	30.12	9	29.77	29	0.32	76.5	...	97.2	17	87.6	54.1	31	67.9	43.1	31.3	31	8.6	3	71.0	65.1	4.37	...	6,209	s.	26	s.	10	5	2	14	15
Leavenworth	842	29.06	—.09	29.91	30.09	31	29.70	16	0.39	78.8	+ 2.7	106.8	16	92.0	52.2	31	68.8	54.6	35.8	24	7.9	3	67.1	65.7	0.73	— 2.70	1,536	s.	22	s.	13	5	1	15	15
Omaha	1,113	28.80	—.07	29.95	30.17	2	29.68	15	0.49	75.6	+ 1.5	99.0	24	86.9	43.6	31	66.9	55.4	30.6	24	10.9	3	65.6	62.1	2.53	— 1.07	4,318	s.	22	n.	16	8	6	12	13
Valentine	2,603	27.29	...	29.92	30.18	31	29.65	12	0.53	71.9	...	98.5	22	85.3	36.9	31	60.1	61.6	40.3	22	14.1	3	61.7	55.4	1.86	...	8,304	sw.	42	n.	3	6	5	12	14
Huron	1,307	28.55	—.06	29.92	30.20	31	29.65	13	0.56	70.0	+ 2.3	100.3	23	84.4	33.1	31	57.9	67.2	42.9	8	14.2	27	72.4	59.1	5.62	+ 2.70	5,749	se.	40	ne.	13	12	3	18	10
Yankton	1,234	28.63	—.07	29.92	30.18	18	29.61	13	0.57	73.0	+ 1.3	99.1	24	85.6	40.7	31	63.2	58.4	34.1	24	11.6	8	76.4	64.2	5.40	+ 2.53	4,318	s.	32	s.	8	10	4	17	10
Northern slope.																																			
Fort Assinaboine	2,690	27.14	—.04	29.91	30.27	29	29.61	23	0.67	68.1	+ 2.8	96.4	3	83.8	37.6	31	51.5	58.8	48.0	31	11.8	1	45.6	43.6	0.35	— 1.55	6,855	w.	42	sw.	29	4	1	15	15
Fort Benton	2,661	27.19	...	29.91	30.30	29	29.61	8	0.69	69.8	+ 1.7	100.0	7	88.0	37.9	30	53.7	62.1	46.9	23	14.9	1	44.8	44.1	0.66	— 0.46	2,610	ne.	49	w.	9	3	3	8	20
Fort Custer	3,040	26.82	—.04	29.89	30.23	29	29.56	23	0.66	71.6	+ 2.2	104.9	22	89.9	37.0	30	56.2	67.9	47.3	23	18.5	2	52.3	51.5	0.71	— 0.52	4,155	se.	32	n.	1	4	0	14	17
Fort Maginnis	4,340	25.59	...	29.92	30.24	29	29.62	23	0.62	65.8	+ 3.0	95.4	23	81.1	37.5	30	53.8	57.9	40.2	23	12.0	1	54.0	47.9	1.79	— 0.02	3,944	n.	21	n.	20	6	3	15	13
Fort Shaw	3,550	26.35	...	29.91	30.27	29	29.63	23	0.64	66.6	+ 3.6	94.2	21	84.5	35.5	30	49.7	58.7	47.5	21	12.4	1	54.5	47.8	0.19	— 0.80	2,517	w.	27	w.	3	4	1	7	23
Helena	4,069	25.84	—.04	29.89	30.23	29	29.61	8	0.62	68.1	+ 1.4	95.1	23	83.9	47.6	31	55.2	47.5	40.6	21	14.8	1	45.7	45.0	0.03	— 0.82	5,385	sw.	36	sw.	19	1	0	8	23
Poplar River	2,030	27.81	...	29.89	30.21	17	29.55	23	0.65	69.0	...	103.5	23	86.3	35.1	31	53.7	68.4	48.8	6	18.0	9	49.9	45.1	0.51	— 0.32	5,967	n.	48	n.	29	7	1	11	19
Deadwood	4,600	25.44	+.01	29.99	30.29	1	29.74	24	0.55	66.8	+ 2.0	93.0	22	78.1	39.5	31	57.4	54.5	31.7	31	7.4	3	64.0	53.1	1.84	— 0.26	1,735	sw.	17	s.	9	5	0	10	21
Cheyenne	6,105	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
North Platte	2,841	27.08	—.04	29.94	30.20	30	29.68	12	0.52	73.8	+ 2.2	99.2	12	86.8	44.7	30	63.0	54.5	31.3	30	11.9	16	68.6	61.1	1.99	— 0.53	6,124	se.	32	s.	8	9	0	14	17
Middle slope.																																			
Denver	5,294	24.81	—.02	29.88	30.13	5	29.69	15	0.44	71.0	+ 0.8	94.3	12	85.2	48.5	30	58.3	45.8	32.6	9	15.9	31	55.9	51.7	1.62	+ 0.09	4,918	s.	34	n.	3	10	2	18	11
Pike's Peak	14,134	18.11	...	29.97	30.15	29	29.83	23	0.33	40.5	+ 2.1	52.1	24	47.3	29.0	30	35.9	23.1	16.2	18	5.4	17	81.6	35.0	3.18	— 0.80	7,253	w.	40	w.	8	23	3	21	7
West Las Animas	3,899	26.06	—.04	29.87	30.18	6	29.65	15	0.53	74.7	+ 2.5	100.2	12	91.1	49.7	30	62.5	50.5	40.5	30	14.1	2	60.8	58.0	1.17	— 0.94	4,477	e.	36	ne.	5	5	2	14	15
Concordia	1,384	28.49	...	29.91	30.12	31	29.64	13	0.42	75.9	...	99.2	23	88.9	49.9	30	65.2	49.3	36.0	24	10.1	31	71.6	65.3	2.46	...	5,157	s.	24	n.	6	7	2	13	16
Dodge City	2,517	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Fort Reno	...	...	...	...	...	...	...	...	...	83.0	...	107.3	17	97.7	59.1	5	68.3	48.2	...	...	...	...	...	...	0.40	— 3.19	...	...	...	...	...	5	...	...	...
Fort Supply	...	...	...	...	...	...	...	...	...	84.8	...	102.4	11	93.5	64.2	31	76.0	38.2	...	...	...	...	...	...	1.14	— 0.86	...	...	...	...	...	7	...	...	...
Fort Elliott	2,650	27.26	—.08	29.88	30.04	6	29.73	13	0.31	77.2	+ 3.2	98.7	16	89.5	58.9	31	66.6	38.9	31.9	19	12.0	21	63.9	62.1	4.57	+ 1.10	6,443	se.	40	nw.	6	5	3	6	22
Southern slope.																																			
Fort Sill	1,200	28.73	—.03	29.93	30.07	10	29.78	29	0.28	82.6	+ 3.2	104.0	16	95.1	62.0	31	71.3	42.0	34.0	16	9.9	21	55.5	63.0	3.40	+ 0.66	6,597	s.	27	s.	16	7	2	13	16
Abilene	1,745	28.18	...	29.92	30.07	10	29.74	21	0.33	82.1	...	100.7	3	93.5	67.0	28	73.0	33.7	25.5	3	11.1	21	60.8	65.6	2.03	...	7,889	s.	48	se.	21	8	3	10	18
Fort Davis	4,928	25.23	—.05	29.91	30.07	10	29.80	20	0.28	75.5	+ 3.8	96.0	5	90.4	58.9	31	65.1	37.1	33.1	12	15.9	2	47.1	51.7	1.97	— 3.30	4,313	ne.	31	ne.	29	7	3	13	15
Fort Stockton	3,004	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Fort Stanton	6,150	24.06	...	29.86	30.06	6	29.64	22	0.42	65.2	...	85.9	13	78.9	48.8	19	55.8	37.1	33.7	11	8.1	22	71.2	54.7	5.45	...	3,265	nw.	22	se.	2	12	2	14	15
Southern plateau.																																			
El Paso	3,764	26.25	—.04	29.87	30.02	6	29.71	13	0.31	80.3	+ 1.4	104.4	13	97.5	65.1	31	69.6	39.3	36.6	12	20.8	2	55.7	61.9	1.85	— 0.43	3,464	e.	28	n.	9	11	1	19	11
Lava	...	...	...	...	...	...	...	...	...	76.6	...	98.2	12	90.8	58.0	31	62.3	40.2	...	...	...	...	...	...	3.32	...	...	...	...	...	...	13	...	...	...
Santa Fé	7,026	23.40	+.07	29.99	30.14	1	29.80	13	0.34	65.3	— 0.7	86.0	9	77.5	51.0	27	56.6	35.0	26.5	8	12.3	23	61.4	50.1	4.15	+ 1.31	4,268	e.	28	n.	9	18	2	14	15
Fort Apache	5,026	25.09	+.02	29.95	30.14	6	29.75	22	0.26	71.8	+ 2.0	97.0	9	88.9	53.3	30	60.2	43.7	37.0	9	12.7	2	64.4	57.3	4.75	+ 0.01	4,251	e.	34	w.	14	11	3	24	4
Fort Bowie	...	...	...	...	...	...	...	...	...	75.9	...	94.0	9	86.3	60.0	14	65.5	34.0	...	...	...	...	...	...	2.49	...	...	...	...	...	...	11	...	...	...
Fort Grant	4,910	25.25	...	29.92	30.08	5	29.75	22	0.34	75.1	+ 0.4	98.2	9	88.6	58.5	14	66.2	39.7	30.5	14	14.3	27	65.8	61.9	3.40	+ 0.07	5,157	ne.	44	se.	14	13	1	23	7
Fort McDowell	...	...	...	...	...	...	...	...	...	87.8	...	117.5	10	107.3	52.3	4	68.4	65.2	...	...	...	...	...	...	0.62	...	...	...	...	...	...	5	...	...	...
Fort Thomas*	2,710	27.16	...	29.80	29.98	6	29.59	17	0.40	83.5	+ 3.1	108.2	9	97.6	61.9	8	70.2	46.3	42.0	8	15.0	27	51.1	60.2	4.02	+ 1.61	3,359	w.	32	s.	14	7	1	17	12
Fort Verde	...	...	...	...	...	...	...	...	...	79.7	— 0.7	101.0	21	89.7	65.0	17	69.7	36.0	...	...	...	...	...	...	3.18	+ 0.12	...	...	...	...	...	11	...	...	...
Maricopa	...	...	...	...	...	...	...	...	...	92.8	...	113.5	9	105.6	71.4	16	80.1	42.1	...	...	...	...	...	...	0.80	...	...	...	...	...	...	3	...	...	...
Phœnix	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Prescott	5,389	24.79	—.01	29.92	30.09	6	29.70	22	0.39	71.2	+ 1.2	92.8	11	83.9	55.5	31	61.6	37.3	31.9	21	12.9	15	66.8	58.0	4.41	+ 1.33	3,829	sw.	24	s.	22	20	3	20	8
San Carlos	...	...	...	...	...	...	...	...	...	86.4	...	110.8	10	103.0	65.0	13	72.5	45.8	...	...	...	...	...	...	3.49	+ 0.38	...	...	...	...	...	13	...	...	...
Willcox	...	...	...	...	...	...	...	...	...	81.4	...	108.0	9	98.7	60.0	11	64.1	48.0	...	...	...	...	...	...	2.14	...	...	...	...	...	...	11	...	...	...
Yuma	141	29.64	—.01	29.75	29.95	6	29.56	22	0.40	89.6	— 1.2	111.6	2†	102.2	74.7	15	79.5	36.9	33.6	21	11.9	5	61.9	73.0	2.23	+ 1.91	4,778	s.	34	se.	1	4	6	9	16
Middle plateau.																																			
Fort Bidwell	4,615	25.39	...	29.93	30.13	26	29.80	23	0.34	69.6	...	91.9	4	84.9	44.5	22	53.0	47.4	42.0	22	21.0	30	28.9	33.1	0.04	...	3,404	w.	22	w.	23	1	0	5	26
Winnemucca	4,358	25.59	.00	29.84	30.05	26	29.62	22	0.43	72.3	+ 1.5	96.7	11	90.3	42.8	26	53.2	53.9	48.7	22	26.9	23	20.0	26.0	trace	— 0.09	4,745	sw.	25	w.	4	0	1	6	24
Frisco	6,406	23.79	...	29.80	29.92	7	29.63	23	0.29	70.3	...	88.3	10	80.6	51.5	31	61.8	36.8	25.8	1	12.0	27	46.6	46.1	3.52	...	6,234	sw.	36	s.	25	15	[illegible]	10	14
Salt Lake City	4,348	25.63	—.02	29.86	29.98	29	29.67	23	0.32	75.6	+ 1.1	99.1	11	88.7	55.2	30	63.5	43.9	31.4	1	15.3	18	76.7	66.6	0.59	— 0.25	3,210	s.	26	nw.	8	5	5	12	14
Montrose	5,780	24.36	...	29.86	29.98	20	29.68	23	0.31	70.1	...	92.6	1	86.1	47.0	30	57.1	45.6	37.8	1	18.3	19	51.8	48.5	1.38	...	4,281	se.	22	s.	10	9	3	18	10
Fort Bridger	6,643	23.61	...	29.97	30.14	8	29.78	31	0.36	62.5	...	86.4	22	78.5	30.8	30	49.4	49.6	40.7	14	13.2	7	60.8	47.4	1.17	...	4,549	sw.	32	w.	12	10	8	9	14
Northern plateau.																																			
Boisé City	2,750	27.10	...	29.86	30.04	29	29.64	22	0.39	73.7	+ 1.6	97.5	6	90.1	48.5	22	55.3	49.0	43.5	22	19.2	31	36.9	43.5	trace	— 0.09	2,348	nw.	15	se.	19	0	0	5	26
Cœur d'Alene	...	...	...	...	...	...	...	...	...	65.0	...	89.0	19	82.2	40.0	26	47.9	49.0	...	...	...	...	...	...	0.00	— 0.06	...	...	...	...	...	0	...	...	...
Ashland	...	...	...	...	...	...	...	...	...	69.3	...	97.0	5	86.9	45.0	21	51.7	52.0	...	...	...	...	...	...	0.00	...	...	...	...	...	...	0	...	...	...
Fort Klamath	...	...	...	...	...	...	...	...	...	58.9	...	89.0	5	80.6	28.0	22	37.2	61.0	...	...	...	...	...	...	0.02	...	...	...	...	...	...	1	...	...	...
Lakeview	...	...	...	...	...	...	...	...	...	64.2	...	92.0	5	84.7	24.0	22	43.8	68.0	...	...	...	...	...	...	0.00	...	...	...	...	...	...	0	...	...	...
Linkville	...	...	...	...	...	...	...	...	...	65.4	...	94.1	5	83.4	41.0	23	47.4	53.1	...	...	...	...	...	...	trace	...	...	...	...	...	...	2	...	...	...
Fort Spokane	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Spokane Falls	1,909	27.90	...	29.89	30.07	26	29.66	19	0.36	68.5	+ 1.2	95.6	6	83.1	45.5	16	53.7	50.1	42.8	19	19.0	21	50.3	48.0	0.33	+ 0.04	3,096	w.	25	w.	1	3	1	3	27
N. Pac. coast region.																																			
Fort Canby	179	29.81	—.02	30.00	30.17	27	29.82	23	0.35	59.5	...	69.4	29	63.7	54.7	3	56.4	14.7	11.6	29	3.4	7	73.7	50.6	1.07	...	6,089	sw.	42	sw.	21	8	15	10	6
Neah Bay	...	...	...	...	...	...	...	...	...	59.4	...	71.5	5	67.5	46.0	16	51.4	25.5	...	...	...	...	...	...	3.70	...	...	...	...	...	...	7	...	...	...
Olympia	36	29.95	—.04	29.99	30.24	25	29.78	22	0.44	63.4	+ 1.5	86.0	5	76.5	44.6	26	51.7	41.4	36.1	17	7.1	20	75.8	54.8	0.42	— 0.34	2,525	n.	16	s.	21	4	5	10	16
Port Angeles	14	29.96	...	29.98	30.24	25	29.74	21	0.50	55.8	...	77.3	30	65.3	43.5	26	48.0	33.8	29.2	29	9.1	12	87.0	51.7	0.88	...	3,429	s.	20	w.	6	6	4	14	13
Pysht	...	...	...	...	...	...	...	...	...	56.7	...	76.0	29	64.9	43.0	15	48.5	33.0	...	...	...	...	...	...	1.50	...	...	...	...	...	...	5	...	...	...
Tatoosh Island	86	29.88	—.05	29.98	30.24	25	29.72	21	0.51	56.6	...	67.3	30	61.8	48.7	29	52.5	18.6	15.7	30	5.2	9	92.7	54.4	4.70	...	6,423	se.	28	ne.	29	11	9	9	13
Astoria	...	...	...	...	...	...	...	...	...	61.8	...	80.0	29	68.1	51.0	26	55.6	29.0	...	...	...	...	...	...	0.56	...	...	...	...	...	...	8	...	...	...
Portland	80	29.87	—.07	29.96	30.18	25	29.76	22	0.42	66.8	+ 1.5	89.6	3	79.8	48.2	25	55.3	41.4	33.5	6	10.0	19	67.6	54.8	0.03	— 0.68	3,699	nw.	20	s.	22	2	5	4	22
Roseburg	523	29.42	—.05	29.98	30.14	25	29.82	22	0.31	66.2	— 1.0	93.8	5	81.8	46.1	9	52.3	47.7	41.2	29	9.7	31	61.3	50.9	trace	— 0.38	2,008	nw.	13	nw.	25	0	1	10	20
Walla Walla	1,018	28.84	...	29.91	30.11	26	29.71	22	0.40	73.9	...	100.0	6	88.2	54.3	22	61.6	45.7	34.5	17	16.3	12	34.6	42.4	0.12	...	4,002	s.	20	s.	12	1	0	1	30
Sitka	63	29.79	...	29.89	30.30	1	29.49	20	0.81	57.8	...	72.0	8	63.1	42.0	28	51.8	30.0	20.5	8	5.0	16	81.3	51.9	10.72	...	4,881	sw.	32	nw.	27	17	18	13	0
Mid. Pac. coast reg.																																			
Cape Mendocino	637	29.28	—0.3	29.95	30.05	8	29.85	26	0.20	56.6	+ 2.0	71.0	27	63.8	46.5	3	51.9	24.5	22.5	4	7.9	13	85.7	52.2	0.26	— 0.03	12,602	n.	42	n.	1	0	1	14	16
Red Bluff	342	29.49	—.04	29.82	29.94	9	29.69	12	0.25	81.5	+ 0.7	103.8	4	95.9	57.2	31	65.4	46.6	37.1	28	22.5	30	32.6	46.9	trace	— 0.04	3,718	s.	16	n.	1	0	0	3	28
Sacramento	64	29.78	—.03	29.83	29.97	6	29.70	1	0.26	71.6	— 0.4	102.0	1	90.4	53.2	21	58.4	48.8	42.8	10	23.0	30	57.8	54.8	0.00	- trace	4,233	s.	18	sw.	6	0	0	0	31
San Francisco	60	29.86	—.02	29.91	30.08	6	29.76	1	0.32	58.5	— 0.1	84.6	26	68.7	48.4	4	52.6	36.2	26.5	28	8.5	16	82.1	52.5	trace	— 0.01	8,790	w.	34	w.	11	0	6	14	11
S. Pac. coast region.																																			
Los Angeles	339	29.53	—.02	29.86	30.04	5	29.70	21	0.34	71.8	+ 1.9	98.1	10	89.1	53.7	23	60.1	44.4	36.7	10	13.8	16	77.2	63.4	0.21	+ 0.21	3,760	w.	18	w.	29	1	2	8	21
San Diego	67	29.82	—.02	29.86	30.00	6	29.73	1	0.27	70.5	+ 1.5	82.5	29	77.5	61.4	25	65.5	21.1	15.7	13	8.2	30	79.0	63.4	trace	— 0.20	4,031	nw.	18	nw.	20	0	2	17	12
San Luis Obispo	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

* Record for 30 days. † 30.2, record for 30 days.

COTTON REGION REPORTS.

In the following table are given the means of the maximum and minimum temperatures and the average rainfall for the cotton districts during the month of August. For the purpose of comparison, the averages for these districts during the four preceding years are also given. The rainfall, as compared with the averages of four years, is excessive in the districts of Wilmington, Memphis, Montgomery, Augusta, and Mobile; it is about normal in the districts of Atlanta and Galveston; in the other districts it is deficient. The mean of the minimum temperatures is above the average in all districts; the mean of the maximum temperature shows only slight departures from the normal.

Temperature and rainfall data for the cotton districts, August.

Districts.	Rainfall.			Temperature.							
				Maximum.			Minimum.			Extremes for Aug., 1886.	
	Average for August of four preceding years.	Average for August, 1886.	Departures.	Mean for Aug. of four preceding years.	Mean for Aug., 1886.	Departures.	Mean for Aug. of four preceding years.	Mean for Aug., 1886.	Departures.	Max.	Min.
	Inch.	*Inch.*	*Inch.*	°	°	°	°	°	°	°	°
New Orleans	4.15	2.69	− 1.46	91.1	92.7	+ 1.6	71.2	71.4	+ 0.2	102	50
Savannah	5.74	5.24	− 0.50	90.8	90.7	− 0.1	71.3	72.4	+ 1.1	106	60
Charleston	7.30	4.16	− 3.14	89.6	88.8	− 0.8	69.0	69.5	+ 0.5	100	43
Atlanta	4.60	4.52	− 0.08	87.9	88.4	+ 0.5	67.4	68.9	+ 1.5	102	57
Wilmington	4.25	7.42	+ 3.17	88.2	87.4	− 0.8	67.3	68.7	+ 1.4	100	55
Memphis	2.64	3.89	+ 1.25	88.6	89.2	+ 0.6	66.0	68.2	+ 2.2	102	44
Galveston	2.32	2.59	+ 0.27	94.0	95.0	+ 1.0	70.5	73.1	+ 2.6	108	55
Vicksburg	3.13	2.32	− 0.81	90.8	92.4	+ 1.6	69.1	71.6	+ 2.5	100	61
Montgomery	3.34	4.57	+ 1.23	90.4	90.2	− 0.2	68.2	69.7	+ 1.5	104	52
Augusta	3.81	4.52	+ 0.71	90.2	88.9	− 1.3	67.9	69.3	+ 1.4	101	58
Little Rock	2.45	2.05	− 0.40	90.7	92.7	+ 2.0	65.7	68.9	+ 3.2	111	49
Mobile	2.95	3.44	+ 0.49	92.2	91.2	− 1.0	69.4	70.3	+ 0.9	104	60

NAVIGATION.

STAGE OF WATER IN RIVERS.

In the following table are shown the danger-points at the various river stations; the highest and lowest depths for August, 1886, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, August, 1886.

[*Expressed in feet and tenths.*]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, Louisiana	29.9	17, 18	3.3	11, 12	−0.8	4.1
Arkansas River:						
Fort Smith, Arkansas	22.0	9	13.7	31	2.7	11.0
Little Rock, Arkansas	23.0	.....	.....	.....	.....	.....
Missouri River:						
Yankton, Dakota	24.0	5, 6	20.1	29, 30, 31	18.1	2.0
Omaha, Nebraska	18.0	11, 12, 13	9.2	31	8.0	1.2
Leavenworth, Kansas	20.0	11	9.8	30, 31	7.0	2.8
Mississippi River:						
Saint Paul, Minnesota	14.5	2, 23	2.5	15	1.2	1.3
La Crosse, Wisconsin	24.0	27	4.6	14, 15, 18, 19	2.3	2.3
Dubuque, Iowa	16.0	31	4.6	16, 17, 18, 21, 22, 23	2.0	2.6
Davenport, Iowa	15.0	31	2.4	17 to 27	1.0	1.4
Keokuk, Iowa	14.0	14	2.6	21, 22, 23, 26, 27	1.0	1.6
Saint Louis, Missouri	32.0	18	9.3	31	6.3	3.0
Cairo, Illinois	40.0	11	11.8	22	9.4	2.4
Memphis, Tennessee	34.0	2	10.0	23, 24	7.8	2.2
Vicksburg, Mississippi	41.0	1	13.5	28	7.9	5.6
New Orleans, Louisiana	13.0	1	4.8	16, 31	3.2	1.6
Ohio River:						
Pittsburg, Pennsylvania	22.0	18	7.7	30	0.3	7.4
Cincinnati, Ohio	50.0	24	13.7	31	7.0	6.7
Louisville, Kentucky	25.0	19	7.3	17	4.5	2.8
Cumberland River:						
Nashville, Tennessee	40.0	7	10.9	1	2.7	8.2
Tennessee River:						
Chattanooga, Tennessee	33.0	8	7.1	30, 31	3.5	3.6
Monongahela River:						
Pittsburg, Pennsylvania	22.0	18	7.7	30	0.3	7.4
Savannah River:						
Augusta, Georgia	32.0	20	11.4	24	7.1	4.3
Mobile River:						
Mobile, Alabama	.....	28	18.4	7	16.7	1.7
Sacramento River:						
Red Bluff, California	.....	1 to 10	2.0	31	0.6	1.4
Sacramento, California	.....	1	10.0	27 to 30	8.2	1.8
Willamette River:						
Portland, Oregon	.....	1	7.5	27	2.6	4.9
Colorado River:						
Yuma, Arizona	.....	27	16.8	14	16.1	0.7

FLOODS.

Yuma, Arizona: on the 1st light rain fell during the greater part of the day. The wind which at 7 a. m. was blowing gently from the south backed to the southeast and increased in force until at 12.15 p. m. it attained a velocity of thirty-four miles per hour. Seventy-five miles west of Yuma the rain was heavy, causing a washout on the Southern Pacific Railroad and delaying trains. On the 15th a thunder-storm began at 10.55 a. m. and continued until 4.30 p. m. During this storm 1.57 inches of rain fell, 0.80 inch falling in twenty minutes, from 2.40 to 3 p. m.; this is the largest rainfall that has occurred since the Signal Service station was established here (1876). The track of the Southern Pacific Railroad was washed out both east and west of Yuma, causing an entire suspension of traffic for several days. On the 27th heavy rain fell in the mountains east of Yuma, producing floods and destructive washouts which delayed trains.

Colorado Springs, Colorado: at 3 p. m. of the 1st very dark and threatening clouds were noticed hanging over the country north of the town, some of these were similar to tornado clouds, being funnel-shaped. Shortly after 3 p. m. very heavy rains set in and being confined within the narrow valley of Monument Creek caused a sudden and destructive freshet. At 6 p. m. the flood suddenly poured into the town, carrying away fences, bridges, and several buildings. Along Monument Creek and Shook's Run thousands of dollars worth of property in bridges and roads were destroyed. The storm was accompanied by unusually heavy hail; above the town on the following day hail still covered the ground to a depth of four inches on an average, in some places it had drifted four feet deep. Large patches of hail from one to three feet deep were deposited along the track of the flood. Trees were denuded of leaves and small branches as well as considerable bark.

Little Rock, Arkansas: during the afternoon and night of the 1st a severe thunder-storm prevailed, beginning at 4.40 p. m., with moderately heavy rain until 8.50 p. m.; at this time very heavy rain set in, and in one hour and ten minutes 2.60 inches had fallen. In consequence of this unusually large rainfall the streets were flooded and property was damaged to the extent of $25,000. Many stores on Main street were filled with water to the depth of eighteen inches.

HIGH TIDES.

Smithville, North Carolina, 26th, 27th, 28th; Cedar Keys, Florida, 18th.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Mount Washington, New Hampshire: at 8.08 p. m. of the 23d an auroral light was observed in the northwest and north. Stratus clouds were banked in the north, obscuring the arch; from behind the clouds bright streamers rose to an altitude of 80°, converging near the zenith. At 8.15 p. m. a bright band of light, elliptical in form, extended across the sky. This band moved slowly across the zenith at 8.32 p. m., after which it began to fade, and disappeared at 9.10 p. m. The aurora proper rapidly increased in brilliancy and extent, at 9.10 p. m. extending from west-northwest to east 10° north. The streamers were unusually narrow but clearly defined and very brilliant. At the time of maximum brilliancy, 9.10 p. m., a lateral motion from west to east was seen. The aurora disappeared at 1.30 a. m. of the 24th.

Washington City: a fine aurora was visible during the evening of the 23d. The first light noted was at 8.15 p. m., and consisted of a patch of greenish light in the north-northeast, near the horizon. This light seemed to spread east and west, in a few minutes the horizon, 30° either side of north, was illuminated by the light. The highest point above the horizon was not more than 15°. At 8.22 p. m. there was a sudden brightening, the light forming an arch, and was accompanied by streamers, which, in some instances, reached an altitude of 45°. This appearance gradually died away, to be succeeded at 8.26 by the same. The moments of brightening and display

of streamers were 8.32, 8.40, and 8.43 p. m. At 8.48 the appearance was quite faint, and at 8.53 p. m. all had vanished except a hazy spot in the north-northwest. At 9.03 the arch of light again appeared fully as bright as before, but there were no streamers up to 9.20 p. m., when the observer ceased to watch the display. The most important point to be noted is the fact that the streamers started from below the arch; not only were they seen to start below the arch but their path across it was distinctly seen. This would seem to indicate that they were independent of the arch. The streamers seemed to converge to a point beneath the horizon.

Beverly, Burlington county, New Jersey: an aurora was visible from 7.30 to 9 p. m. of the 23d. It first appeared as a pink glow, afterwards as a low white arch. At 8.40 p. m. three narrow white streamers appeared. The arch disappeared at 8.50 p. m., leaving only a white glow in the northeast.

New York City: an aurora was seen at 8 p. m. of the 23d, illuminating the northern horizon. The light appeared in the shape of a well-defined arch, covering about 100° of azimuth. At times the light became quite brilliant, with streamers shooting upward and outward, giving the display the appearance of a blazing fan.

Bancroft, Kossuth county, Iowa: an auroral display commenced at 8.10 p. m. of the 23d and continued, with varying degrees of brightness, until 11 p. m. It consisted of a bright arch, with rapidly changing streamers darting from the upper surface.

Gardiner, Kennebec county, Maine: brilliant auroral streamers were seen flashing from above a dark cloud at 9 p. m. of the 23d. At 10 p. m. the streamers had coalesced and the display resembled moonlight.

Winnemucca, Nevada: a faint aurora was visible for about two hours during the evening of the 23d. It was first seen about 8 p. m. and disappeared at about 10 p. m. The light faded away so gradually that it was scarcely possible to note the exact minute of its disappearance. The display was brightest at a few minutes after 9 p. m., though at no time was it very brilliant. Its first appearance was in the form of a yellow glow in the northern horizon, which became more distinct as the twilight faded and the sky became darker. It then presented the appearance of an irregular arch of yellow light. At times a greenish tint could be observed near the upper edge of the arch. The azimuth of the western extremity was 155° and of the eastern 215°; altitude, 15°. The degree of brilliancy varied at times, but there were no flashes of light, nor any motion of the arch, except that in disappearing the size of the arch diminished, seeming to sink down and finally disappear below the horizon.

Duluth, Minnesota: an aurora was observed from 9.30 p. m. of the 23d until daylight of the 24th. The aurora as first seen consisted of pale yellow light extending from azimuth 95° to 260°. At 10.30 p. m. it had gradually assumed the form of an arch, which extended from azimuth 110° to 255°, with an altitude of 30°. Streamers appeared at 10.45 p. m., and continued to increase in size and number until 11.15, when the display was quite brilliant.

Fort Buford, Dakota: a fine auroral display commenced at 10.25 p. m. of the 23d. It first appeared as two brilliant white arches of light extending from northwest to east. The height of the upper arch was about 25°. The lower arch was bounded beneath by a very dark segment through which the stars were dimly seen. At 11 p. m. a third, and part of a fourth arch were formed, the fourth extending nearly to the zenith. At this time the eastern extremities of the arches began to break into yellow streamers which shot up like flames to a height of 30°. At 11.30 p. m. the western sides of the arches were perfect, while the eastern ends assumed the form of a large white curtain swayed by the wind. The display faded from view shortly before midnight.

La Crosse, Wisconsin: a red auroral light was noticed at 9.20 p. m. of the 23d in the northern sky. At 9.45 p. m. a pale white arch had formed. Shortly after 11 p. m. a second arch was seen, at an altitude of 50°, slowly advancing toward the zenith. The aurora disappeared at 11.47 p. m.

Auroral displays were also observed during the month, as follows:

2d.—Embarras, Wisconsin.

4th.—Vevay, Indiana; Parkersburg, West Virginia.

5th.—Vevay, Indiana.

7th.—Webster, Dakota; Poplar River, Montana.

11th.—Fort Totten, Dakota; Heath, Massachusetts; Egg Harbor City, New Jersey.

12th.—Eastport, Maine; Palermo, New York.

13th.—Fort Totten, Dakota; Mackinaw City, Michigan; Duluth, Minnesota.

14th.—Eastport, Maine; Mackinaw City, Michigan.

16th.—Westborough, Massachusetts.

17th.—Fort Totten, Dakota; Mackinaw City, Michigan; Newport, Vermont.

20th.—Orono, Maine; Berlin Mills, New Hampshire; Newport, Vermont.

21st.—Lunenburg, Vermont.

22d.—Block Island, Rhode Island.

23d.—New Haven, New London, Hartford, North Colebrook, and Southington, Connecticut; Webster and Fort Totten, Dakota; Riley, Illinois; Fort Madison, Independence, Manchester, and Monticello, Iowa; Allison, Kansas; Eastport, Portland, Bar Harbor, and Orono, Maine; Woodstock, Maryland; Blue Hill Observatory, Cambridge, Boston, Fall River, Milton, Princeton, Somerset, and Westborough, Massachusetts; Grand Haven, Mackinaw City, and Traverse City, Michigan; Moorhead, Minnesota; Poplar River, Montana; Valentine, Nebraska; Nashua, New Hampshire; Beverly, Clayton, Dover, Moorestown, and Upper Mountclair, New Jersey; Albany, Cooperstown, Factoryville, Mountainville, and Setauket, New York; Bethlehem, Catawissa, Dyberry, and Wellsborough, Pennsylvania; Variety Mills, Virginia; Fort Spokane, Washington Territory; Manitowoc and Prairie du Chien, Wisconsin.

24th.—New London, Connecticut; Lunenburg and Post Mills, Vermont.

25th.—Pekin, Illinois.

26th.—Pekin, Illinois; Atlantic City, New Jersey; Newport, Vermont.

27th.—Windsor, Illinois.

THUNDER-STORMS OF AUGUST, 1886.

[By Jr. Prof. H. A. HAZEN.]

During August there were received from voluntary observers 631 reports of distinct storms; from Signal Service observers 337; and from special thunder-storm observers 1,884, making a total of 2,852, or 470 more than during June, and 144 more than during July. The distribution by states and districts will be seen in the accompanying table. This table does not give an idea of the relative frequency in the different states, as some have many more observers than others, but it will serve for comparison with similar tables in previous months. The days of greatest number were 1st, 219; 11th, 203; 12th, 238; 13th, 273; and 16th, 298; and of least number, were 2d, 19; 3d, 12; 7th, 14; 19th, 17; 20th, 18; 24th, 6; 25th, 17; 26th, 13; and 31st, 18. It will be seen that there were two well-marked periods of thunder-storm activity, from the 11th to 17th, and from the 27th to 30th. On the 16th the conditions were specially interesting, it being the hottest day of the month, the temperature rising to 104° in the afternoon. On this date there were the most storms of any day, and some idea of the conditions on this date may be gleaned from chart ix. Most all the storms on this date occurred before noon, hence the map of isobars, isotherms, and wind-directions has been chosen for 7h.00. It will be seen that, as in the previous month, nearly every storm is in the southeast quadrant of the low area. This chart is specially interesting as showing the conditions ushering in the tornadoes of the afternoon of this date, elsewhere described in detail.

Thunder-storms by districts, August, 1886.

District.	State.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	Total.
I	Connecticut	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1	4
	Maine	1	1	.....	.....	.....	.....	1	.....	1	.....	3	.....	.....	1	.....		.....	.....	1	.....	..	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	10
	Massachusetts	.....	1	.....	.....	1	1	.....	.....	.....	.....	3	7	.....	12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	2	29
	New Hampshire	3	.....	.....	.....	1	.....	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	6
	New York	17	2	.....	.....	.....	.....	.....	.....	.....	.....	9	.....	12	5	.....	11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	12	1	79
	Rhode Island	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
	Vermont	4	2	.....	.....	.....	.....	.....	.....	.....	.....	7	.....	1	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19
	Total	24	6	.....	.....	2	1	1	1	1	.....	24	7	13	28	.....	11	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	13	6	151
II	Delaware	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
	Maryland	6	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	3	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	.....	8	.....	22
	New Jersey	3	2	.....	.....	2	1	.....	.....	.....	.....	4	.....	.....	5	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	5	2	1	28
	North Carolina	.....	1	.....	.....	.....	3	.....	.....	.....	.....	2	4	7	3	3	.....	7	7	1	.....	.....	.....	.....	.....	.....	1	2	1	1	1	.....	.....	45
	Pennsylvania	10	.....	.....	1	3	.....	2	.....	.....	1	1	.....	5	2	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	2	5	2	38
	Virginia West Virginia	7	.....	.....	.....	2	6	5	.....	2	1	1	7	8	6	1	1	9	4	.....	.....	1	1	1	.....	3	1	2	6	6	7	1	89
	Total	26	3	.....	1	7	11	7	.....	2	2	8	11	23	16	4	6	18	11	1	1	1	1	1	.....	4	3	4	10	14	22	4	222
III	Illinois	9	1	.....	1	6	10	.....	.....	.....	.....	10	21	18	4	13	8	9	8	.....	.. ..	2	3	.....	.....	.....	.....	2	12	19	1	.....	157
	Indiana	11	.....	.....	.....	.....	12	.....	.....	.....	.....	8	18	18	8	5	24	11	2	1	.....	2	18	2	.....	.....	.....	3	14	19	1	.....	177
	Kentucky	.....	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	2	1	1	1	.....	1	1	.....	.....	.....	1	.....	.....	1	... .	.....	.....	1	1	.....	.....	14
	Ohio	123	3	.....	4	10	33	2	3	3	1	74	81	103	89	9	199	20	.....	.....	1	22	144	12	.....	5	1	2	26	83	28	1	1,102
	Tennessee	5	...	.....	.....	1	5	....	.....	.....	.....	.....	4	.....	.....	5	.....	7	4	2	2	.....	7	9	6	1	2	8	7	6	4	1	86
	Total	148	4	.....	5	17	83	2	3	3	1	92	126	140	102	33	231	48	15	3	3	26	173	23	6	7	3	15	60	128	34	2	1,536
IV	Michigan	3	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	3	10	.....	3	7	2	.....	.....	2	14	3	.....	.....	.....	.....	4	9	8	.....	.....	69
	Minnesota	.....	.....	.....	.....	1	.....	.....	1	4	1	4	1	2	.....	6	.....	.....	.....	2	1	5	.....	.....	.....	.....	1	1	.....	.....	.....	.....	30
	Wisconsin	1	.....	.....	3	1	3	.....	.....	.....	.....	1	1	4	.....	3	7	.....	.....	.....	6	10	1	... .	.....	.....	1	2	7	1	.....	.....	52
	Total	4	.....	.....	3	2	4	.....	1	4	1	5	5	16	.....	12	14	2	.....	2	9	29	4	.....	.....	.....	2	7	16	9	.....	.....	151
V	Dakota	.....	.....	.....	3	2	.....	2	.....	4	3	1	4	2	5	6	.....	.....	.....	1	1	1	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	38
	Iowa	10	1	.....	10	34	6	1	22	11	17	67	79	70	25	46	26	18	2	7	3	16	.....	.....	.....	1	.....	20	40	7	1	1	541
	Nebraska	1	3	1	1	3	.....	1	3	6	5	3	3	6	1	1	3	3	.....	1	.....	1	.....	.....	.....	.....	.....	1	1	.....	.....	.....	48
	Total	11	4	1	14	39	6	4	25	21	25	71	86	78	31	53	29	21	2	9	4	18	.....	.....	.....	4	.....	21	41	7	1	1	627
VI	Arkansas	2	.....	1	.....	.....	1	.....	.....	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	2	2	.....	.....	12
	Indian Territory	.....	.....	.....	1	1	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	.....	1	.....	1	.....	.....	.....	.....	7
	Kansas	2	2	7	2	12	.....	.....	6	7	10	2	.....	1	4	1	3	4	.....	.....	1	.....	1	.....	.....	1	5	12	6	3	.....	5	97
	Missouri	2	.....	3	1	2	.....	.....	.....	.....	7	.....	3	2	1	3	4	8	2	.....	.....	.....	2	.....	.....	.....	.....	5	2	2	.....	.....	49
	Total	6	2	11	4	15	1	.....	6	8	18	3	3	3	5	4	7	12	2	1	1	1	3	.....	.....	2	5	20	10	7	.....	5	165
	Grand total	219	19	12	27	82	103	14	36	39	47	203	238	273	162	106	298	101	30	17	18	73	181	24	6	17	13	67	137	177	70	18	2,852

CHART OF ELECTROMETER READINGS.

[By Prof. T. C. MENDENHALL, Assistant.]

Observations have been made during the month of August, as usual, at all stations.

At Boston, Massachusetts, negative indications occurred on the following dates: 1st, 3d, 4th, 5th, 9th, 12th, 14th, 16th, 25th, and 30th. Rain occurred during night of 1st; afternoon of 3d; during night of 5th; during night of 7th; during afternoon of 12th; morning of 14th; and afternoon of 30th. The morning of the 25th was cloudy and threatening. The only date during the month on which rainfall was not accompanied or preceded by negative indications was August 7th. This was a foggy and damp day with fresh east winds, and was characterized by unusually high positive potentials.

At Ithaca, New York (Cornell University), negative values occurred on the 1st during thunder-storm; on the 3d, following rain; on the 2d; on the 5th, preceding rain several hours; on the 7th, following rain; on 16th, preceding rain; and on 17th, unaccompanied by rain. A very severe thunder-storm occurred on the evening of the 11th, not preceded by any unusual indication. A severe thunder-storm occurred on the 16th in which the indications were throughout positive, ranging from 152 to 2,625 volts.

The first diagram of chart vi represents a series of mean values for that part of the day between 9 a. m. and 3 p. m., obtained in the following way: All dates of thunder-storms and abnormal variations are omitted in this discussion of mean values, as it is evident that the great values obtained at these times would either masque or distort the diurnal variation due to more regular causes. Groups of five days are taken, and the mean of each of the four daily observations determined. This, in the case of Washington City, is represented by the line numbered 1; the mean observations made on June 29th, 30th, July 3d, 4th, and 5th; intervening dates being omitted for the reasons above stated. The mean values for the 9 and 11 a. m., 1 p. m., 3 p. m. observations were, 138, 126, 138, and 114 volts, respectively. Similarly for the 6th, 7th, 8th, 10th, and 16th, the curve numbered 2 represents the mean values 92, 95, 100, and 91 volts. For the 17th, 18th, 20th, 22d, and 24th, curve numbered 3 represents 75, 91, 102, and 109 volts; and for the 26th, 27th, 28th, and August 4th and 5th, curve numbered 4 represents 78, 90, 99.6, and 107 volts. The mean of these values, in turn, is represented by the dark-lined curve numbered 5. The values are 76.6, 80.4, 85.0, and 84.0; or, for this time and locality, the curve seems to show a steady rise during the forenoon, reaching a maximum about the early part of the afternoon.

The second diagram on chart vi. represents a like determination for Boston, Massachusetts. Observations are made here at the Massachusetts Institute of Technology, and for many reasons we ought not anticipate any striking correspondence. Curve number 1 represents the mean of the observations made on June 29–30th, July 1st, 2d, 3d, giving as values—minus 8.9, minus 11.9, minus 7.6, and plus 18.3. From the 4th to the 8th, inclusive, the values are throughout on the negative side, 13.7, 12.8, 16.9, and 15.4. From the 9th to 13th, inclusive, the values are positive, 9.6, 7.8, 6.3, and 6.2, represented by curve numbered 3. Curve numbered 4 gives the values from the 14th to the 18th, inclusive, viz., 5, 10, 26.2, 14.2; curve numbered 5, the values from the 18th to the 23d, 65.5, 90.7, 128.2, and 125.1, and curve numbered 6, the values of the 24th, 25th, 26th, 27th, and 29th, minus 1.3; plus 43.8, 44.5, 54.3. The mean for the month is represented by the curve numbered 7, representing the following mean values for the four observations at 9 and 11 a. m. and 1 and 3 p. m., 9.4, 21.3, 29.6, 33.8, respectively.

The third portion of the first diagram of chart vi gives the values, obtained in the same way, for New Haven, Connecticut. From June 24–29th, the mean values are 9.4, 8.2, 9.0, and 8.6; from June 30th to July 5th, 11.6, 15.8, 8.6, 8.8; from July 6th to 10th, represented by curve numbered 3, 9.4, 15.4, 8.6, 9.0, from July 12th to 17th, represented by curve numbered 4, 12.0, 7.0, 5.8, 12.0, and from 19th to 24th, omitting the 21st,

9.6, 9.4, 7.0, and 8.4. The total mean for the month, represented by curve 6, 10.4, 11.1, 7.8, and 9.3.

The second diagram of chart vi represents the potential variations at Boston, Massachusetts, during the passage of a light thunder-storm, about four miles to the southwest of the place of observation, August 3d, 1886.

The following is abstracted from the observer's report:

Time.	Volts.	Remarks.	Time.	Volts.	Remarks.
P. M.			*P. M.*		
1.00	+ 20	Storm in sw.; wind from sw.	2.08	+ 85	
			2.10	+105	
1.02	+ 40		2.12	+ 60	
1.04	+ 10		2.14	+ 55	
1.06	— 8	Brisk; weather fair at Boston.	2.16	+ 45	
			2.18	+ 50	
1.08	+ 20		2.20	+ 65	
1.10	+ 15		2.22	+ 55	
1.12	+ 40		2.24	+ 34	
1.14	+ 50		2.26	+ 58	
1.16	+ 52		2.28	+ 65	
1.18	+ 61		2.30	+ 40	
1.20	+ 20		2.32	+ 80	
1.22	— 38		2.34	+ 75	
1.24	+ 75	Cloud passing overhead.	2.36	+ 55	
			2.38	+ 55	
1.26	+114		2.40	+ 45	
1.28	+140		2.42	+ 20	
1.30	+168		2.44	+ 5	
1.32	+151		2.46	— 25	Heavy clouds overhead.
1.34	+ 80				
1.36	+ 40		2.48	— 17	
1.38	+ 40		2.50	— 20	
1.40	+ 48		2.52	— 20	
1.42	+ 40		2.54	— 2	
1.44	+ 10		2.56	+ 10	Very light rain began 2.56, ended 2.57 p. m.
1.46	— 41				
1.48	+ 37				
1.50	+ 35		2.58	— 2	Rain from a single cloud.
1.52	+ 50				
1.54	+ 48		3.00	—120	
1.56	+ 30		3.02	— 60	
1.58	+ 25		3.04	+ 15	Light rain.
2.00	+ 20		3.06	+ 15	Rain ended.
2.02	+ 10		3.08	+ 15	
2.04	+ 60		3.10	+ 15	Clear; .2 cum. strat. clouds.
2.06	— 20				

The third diagram of chart number vi represents the conditions observed at Ithaca, New York, during passage of a thunder-storm. The values obtained at this station, owing to the altitude of the place and the exposure, are always greatly in excess of those obtained elsewhere.

The following table is abridged from the observer's report of special observations made during the storm of August 1, 1886:

Time.	Volts.		Remarks.
P. M.	*Plus.*	*Minus.*	
2.53 00			First thunder heard; wind, southwest brisk; storm west of station, moving north.
3.03 00	265		
3.04 00	220		
3.05 00	140		
3.06 00	75		Very distant thunder heard.
3.07 00		35	
3.08 00		150	Continuous rumbling; distant storm, northwest of station.
3.09 00		350	
3.10 00		550	
3.11 00		700	
3.12 00		830	
3.13 00		940	
3.14 00		980	
3.15 00		970	Storm in northwest.
3.16 00		960	
3.17 00		960	Thunder heard.
3.18 00		953	
3.19 00		955	
3.20 00		962	
3.21 00		945	
3.22 00		955	Thunder heard.
3.23 00		965	Continuous rumble.
3.24 00		965	Another storm in west; very distant, but coming towards station.
3.25 00		950	
3.26 00		945	
3.27 00		1005	Loud thunder.
3.28 00		980	
3.29 00		977	
3.30 00		1000	Storm in southwest.
3.31 00			Rain commenced.
3.32 00		1010	
3.33 00		1250	
3.34 00			Off scale negative.
3.39 00	600		
3.40 00	900	7500(?)	Sudden oscillation of needle.
3.41 00			Thunder heard.
3.42 20			Thunder heard.
3.43 00		1500	
3.43 10		900 to 7500(?)	
3.43 30			Thunder heard.
3.43 55		3000, 6300, 7500	Needle swinging.
3.44 10			
3.45 00			Off scale negative.
3.46 00		1200	
3.47 00	900		
3.48 15	1200	2100	
3.48 30			Thunder heard.
3.49 00			Wind in gusts.
3.50 00	00		Heavy rain.
3.50 55	2400		
3.51 20		1800	
3.51 50			Thunder heard.
3.52 00	900		
3.53 00		300	High wind and rain.
3.53 30	00		A lull in storm.
3.54 00	900		
3.55 00		600	Wind in gusts.
3.55 55		3900, 900	Heavy rain.
3.56 15		2100, 00	Heavier rain.
3.57 15	600	3900	
3.58 00		4800, 1500	Wind southwest; heavy wind and rain.
3.59 00	900		
4.00 00		1800	
4.00 07	1500		
4.00 25			Thunder heard.
4.01 00		1800	
4.02 00		1200	
4.03 00		2100	
4.03 10	3900		
4.03 27			Thunder heard.
4.04 00		2100, 900	
4.05 00		3000	
4.06 00	1500		
4.07 00	1500		
4.08 00		1200	
4.08 40	3000		
4.08 50			Thunder heard.
4.09 00	1200		
4.10 00		1800	
4.10 05	900		Thunder heard.
4.10 30	2400		Thunder heard.
4.11 00		1200	
4.11 15	3900		Lightning simultaneous with oscillation.
4.11 25			Loud thunder.
4.12 00		2100	Rain diminishing.
4.12 55	1500		
4.13 10		1500	Thunder-storm.
4.15 00	00		
4.16 00		900	

Time.	Volts.		Remarks.
P. M.	*Plus.*	*Minus.*	
4.17 00	2400		Thunder heard.
4.18 00	600		
4.19 00	2000		
4.19 10	1500	1200	
4.19 30	00		Thunder heard.
4.20 00		900	
4.21 00	1800		
4.23 00	3900		
4.24 00	2400		Rain diminishing.
4.24 15	2100	2700	
4.24 30			Thunder heard.
4.25 00	2700		
4.26 00	300		
4.27 00		300	Raining hard.
4.28 00		1080	
4.29 00		750	Clearing.
4.30 00	1500		
4.31 00	300		Rain ended.
4.32 00		450	
4.33 00	210		

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos were observed in the various states and territories, as follows:

Alabama.—Mobile, 2d.

Arizona.—Yuma, 5th, 28th; Prescott, 28th.

California.—San Diego, 1st, 6th, 8th, 11th, 28th.

Colorado.—Montrose, 22d.

Florida.—Archer, 1st, 31st; Key West, 26th, 28th.

Georgia.—Savannah, 29th, 31st.

Illinois.—Pekin, 1st, 23d, 29th; Riley, 3d, 6th, 9th, 19th.

Indiana.—Indianapolis, 3d; Vevay, 5th, 21st.

Iowa.—Corydon, 9th; Cedar Rapids, 18th.

Kansas.—Manhattan, 5th, 17th; Yates Centre, 8th, 20th; Wyandotte, 23d, 24th, 26th, 29th, 30th, 31st.

Maine.—Orono, 16th.

Massachusetts.—Blue Hill Observatory, 4th; Provincetown, 16th.

Michigan.—Port Huron, 1st, 20th; Grand Haven, 11th.

Nebraska.—Omaha, 8th.

New Jersey.—Dover, 12th; Clayton, 13th, 24th.

New York.—Oswego, 4th, 5th.

North Carolina.—New River Inlet, 27th, 30th.

Ohio.—Wauseon, 11th, 19th, 20th, 21st.

Pennsylvania.—Erie, 9th; East Brook, 22d.

South Carolina.—Stateburg, 6th, 8th, 11th, 24th; Spartanburg, 31st.

Tennessee.—Nashville, 16th, 17th.

Texas.—Galveston, 2d.

Vermont.—Strafford, 16th.

Virginia.—Variety Mills, 3d, 6th, 24th; Dale Enterprise, 3d, 11th, 21st; Lynchburg, 17th, 19th, 20th, 25th; Rappahannock Station, 21st.

Wyoming.—Fort Bridger, 2d, 30th.

LUNAR HALOS.

Lunar halos were observed in the various states and territories, as follows:

Arizona.—Yuma, 4th, 10th, 11th, 12th.

California.—Sacramento, 17th.

Connecticut.—New Haven, 11th, 17th.

District of Columbia.—Washington City, 7th, 9th, 11th.

Florida.—Archer, 5th, 8th, 9th, 14th, 15th; Jacksonville, 8th, 15th; Key West, 10th, 15th; Limona, 13th; Manatee, 12th, 14th.

Georgia.—Augusta, 6th, 24th; Savannah, 15th.

Illinois.—Pekin, 5th, 9th, 11th, 20th; Riley, 8th, 18th.

Indiana.—Lafayette, 9th.

Iowa.—Independence, 5th, 15th; Cedar Rapids, 19th.

Kansas.—Dodge City and Yates Centre, 8th; Allison and Westmoreland, 10th; Independence, 11th; Wyandotte, 20th.

Kentucky.—Louisville, 10th; Frankfort, 12th, 16th.

Maryland.—Baltimore, 12th.

Michigan.—Lansing, 8th.

Nebraska.—De Soto, 8th, 15th.

New Hampshire.—Nashua, 14th.

New Jersey.—Beverly and Egg Harbor City, 11th; Moorestown, 13th.

New Mexico.—Fort Stanton, 6th, 11th.

New York.—Setauket, 6th, 13th; Ithaca, 9th.

North Carolina.—New River Inlet, 13th; Fort Macon, 17th.

Ohio.—Elyria, 4th; Columbus, 12th to 15th; Napoleon, 13th.

Pennsylvania.—Catawissa, 13th; Pittsburg, 20th.

South Carolina.—Stateburg, 8th, 13th; Spartanburg, 10th, 12th, 14th, 17th, 18th.

Tennessee.—Nashville, 12th, 13th; Chattanooga, 18th; Ashwood, 19th.

Texas.—Cleburne, 3d; Palestine, 5th, 10th; Brownsville and Rio Grande City, 10th.

Virginia.—Dale Enterprise, 7th, 10th, 11th, 20th; Rappahannock Station, 9th to 13th, 15th; Bird's Nest, 9th, 12th, 13th, 15th, 17th; Cape Henry, 13th.

Washington Territory.—Neah Bay, 7th; Tatoosh Island, 8th.

West Virginia.—Parkersburg, 12th.

Wisconsin.—Milwaukee, 12th; Manitowoc, 15th.

Wyoming.—Fort Bridger, 7th.

The phases of the moon (Washington mean time) during August, as given in "The American Ephemeris and Nautical Almanac" for 1886, are as follows: New moon, 28th, 19 h. 46.1 m.; first quarter, 6th, 3 h. 58.0 m.; full moon, 14th, 1 h. 16.0 m.; last quarter, 22d, 2 h. 33.6 m.; apogee, 14th, 20.6 h.; perigee, 28th, 19.9 h.

MIRAGE.

Nicolaus, Sutter county, California: a mirage occurred here on the 9th, distant houses being plainly seen elevated above their usual position.

The following is from the "New York Herald" of August 14, 1886:

The phenomenon known as mirage was witnessed at 7 a. m. of the 12th at Rondout, New York. In the foreground cattle were seen lazily chewing their fodder, while close by were the farmer's house, barn, and other out-buildings. In the background the picture of a pretty rural scene was presented to the eye. The atmosphere was murky. The spectacle, which was viewed by a number of well known citizens, is said to have been the first of the kind seen in Ulster county within the memory of the oldest inhabitant.

Mirage was observed at other stations, as follows:

Webster, Dakota, 17th, 20th, 21st, 30th, 31st.

Salina, Kansas, 22d, 24th, 26th.

Egg Harbor City, New Jersey, 24th.

MISCELLANEOUS PHENOMENA.

DROUGHT.

Lead Hill, Boone county, Arkansas: very warm weather prevailed from the 12th to the 18th, with dry wind from the southwest, which, combined with the drought, was very damaging to vegetation.

Keokuk, Iowa, 31st: the corn crop on uplands is almost ruined by the drought, although copious rains fell from the 11th to the 18th. These rains were of benefit only to corn that had been planted late in bottom lands.

Fort Sill, Indian Territory: on the afternoon of the 19th a thunder-storm and heavy rain set in. This was the second heavy rain since the beginning of the drought, April 26th, and the prospects for cattle grazing were somewhat brightened. During this storm 1.53 inches of rain fell.

Mackinaw City, Michigan: heavy rain fell on the 21st and 22d, breaking the drought that had continued since the middle of June. Owing to the drought the hay and grain crops have been seriously injured, and mills using water as a power were obliged to cease operations early in July on account of the low water in streams.

Milwaukee, Wisconsin: on the 21st the severe drought which

had prevailed over this state during the past sixty days was broken in this section, and over the state generally, by a heavy rain which began at 3.50 p.m. and continued until after midnight. The damage done by the drought is very great throughout the state. The crops of hay, oats, corn, potatoes, and wheat are far below the average. Owing to the dry weather severe forest fires prevailed for several weeks in the northern part of the state, doing great damage to farms, timber property, and cranberry marshes. Several villages were partly destroyed by the fires, and others damaged. A large number of farm houses and saw mills were burned.

Lansing, Michigan: heavy rain fell on the 21st, 1.12 inches, and on the 28th and 29th, 3.45 inches. As a result of the long drought which existed previous to these rains, pastures in this vicinity are dry and farmers are obliged to feed their cattle with hay.

Liberty Hill, Bienville parish, Louisiana: drought has prevailed here from the 27th of July until the 25th of August, and will decrease the yield of cotton.

Mexico, Audrain county, Missouri: the first rain since June 26th fell on the afternoon of the 12th. The rain was of great benefit to farmers, whose crops were suffering from drought.

Dallas, Texas, 27th: Stevens, Shackelford, Young, Palo, Pento, Throckmorton, Eastland, and Baylor counties are still suffering from drought. Some parts of these counties are entirely denuded of grass, and cattle are dying in large numbers.

Thornville, Lapeer county, Michigan: although several light rains fell during the month, the drought was not broken until the night of the 29–30th when 1.20 inches fell.

J. W. Sanborn, Secretary of the "State Board of Agriculture" for Missouri, makes the following report in reference to the drought:

> Corn has gone steadily down for August, and its general condition is now sixty-one per cent. Drought and heat have been general over the state, and the few short rains were inadequate to break it. The crop is now made and will not materially change. All other crops and pastures have suffered from drought.

Abilene, Texas, 31st: the drought in this section is over; copious rains have fallen during the month in the surrounding country, with a few showers at this place.

Lawrence, Douglas county, Kansas: the July drought was broken on the 1st by a copious shower. There were seven other serviceable rains during the month, but no rain sufficiently heavy to wet the ground to a greater depth than two inches.

The observer at Topeka, Kansas, reports, concerning the drought, as follows:

> August has been a very warm month in Topeka. Such long continued warm weather has not occurred during the past eight years. When this is considered with reference to the hot July it is not surprising that the effects of the drought are severe. Corn in many fields, especially the late planted, is worth little except for fodder. Likewise all crops that depend upon July and August weather for maturing have suffered severely. The rains of August would have sufficed for the crops had July left us better prepared or had the heat and hot winds been less intense. Western Kansas has, contrary to common experience, been comparatively more favored with rain than the eastern part of the state.

EARTHQUAKES.

Report on the Charleston Earthquake.

[By Prof. T. C. MENDENHALL, Assistant.]

The earthquake of August 31st, which, from the locality in which its greatest power was displayed, will generally be known as the "Charleston Earthquake," was, perhaps, the most notable disturbance occurring within the limits of the United States of which we have any knowledge. It is entitled to this rank both on account of the wide area over which it was distinctly felt, and of the magnitude of the disaster which it caused in the immediate vicinity of the point of maximum intensity.

The earthquake consisted of a series of seismic disturbances which began in slight but distinctly noticeable tremors occurring on August 27th and 28th, at the town of Summerville, about twenty-five miles northwest of Charleston, South Carolina.

The shock of greatest violence occurred a little before ten o'clock on the night of Tuesday, August 31st. It was followed by several of lesser magnitude on that night, and during the succeeding three or four weeks. The great shock began in the city of Charleston within a few seconds of 9.51 p. m., 75th meridian time. The duration of the vibratory motion of the earth at that point was probably about forty seconds; the motion at first being moderate, but increasing with great rapidity during the last ten or fifteen seconds.

All of the loss of life and property during the whole series of disturbances is to be attributed to this first shock. Five minutes later another occurred, and ten minutes later still another; the latter being of considerable violence, but neither alone would have done any damage. The same may be affirmed of the succeeding series of disturbances which, with greatly diminished intensity and at increasing intervals of time, continued to maintain the conditions of alarm and terror into which the people of the afflicted locality were naturally thrown by the first disturbance. Although some injury to buildings resulted from these after shocks, it is tolerably certain that in all such cases displacement and fracture had taken place in the great shock; the lesser disturbances simply finishing what had then been nearly completed.

The origin of the disturbances appears to have been somewhere below a point fifteen or twenty miles northwest of Charleston; that is, in the neighborhood of the town of Summerville. A chart of provisional co-seismal lines drawn by Mr. Hayden of the Geological Survey, and published in "Science" for September 10th, seems to locate this centre somewhat further north than the point indicated above. At the time of its construction, however, information from many points was lacking, and that which was at hand was admitedly doubtful in some degree.

Reference will be made later to the iso-seismal chart accompanying this report, which indicates that the origin was near the point referred to above. Strong proof of this is also furnished in the intensity and character of the disturbance as shown by the effects which were still visible when an examination was made a few days after the principal shock. The appearance of brick piers upon which many houses in Summerville rest was such as to justify the conclusion that the principal component of the motion at that point was vertical, and it was evident that the destruction of buildings was much less than would have resulted from a horizontal movement equal to that which had taken place in Charleston and elsewhere in the neighborhood.

Another fact of importance is that in the vicinity of Summerville the disturbances preceding that of August 31st took place, and here they have been most numerous and most persistent. Indeed, at the present writing, nearly a month after the first perceptible shock, they still occur at irregular intervals varying from a few hours to a few days. Only the most violent of these have been felt as far as Charleston.

Nearly all the movements in Summerville and vicinity have been accompanied by, and, indeed, generally preceded by, a low rumbling sound, lasting one or two seconds, and not infrequently this sound, always unmistakable in its character, was neither accompanied nor followed by a perceptible movement. This was a common occurrence at Summerville and in the immediate vicinity, and it was found that among several observers there would be no agreement upon the direction from which the sound appeared to come.

At a distance from ten to fifteen miles from Charleston in the direction of Summerville some of the most curious and interesting effects of the disturbance were to be seen. These were the "sand craters" and crevices, out of which extensive eruptions of sand and water had taken place on the night of August 31st. The craters thus formed varied in size from an irregular oval, twenty-five feet long by fifteen feet wide, to shallow cones not over an inch in diameter and beautifully symmetrical in form. The area surrounding these openings was generally flooded with sand, often acres in extent, to a

depth varying from a fraction of an inch to fifteen and eighteen inches. About the larger cavities the average depth was probably not less than six inches, and the area covered often an acre or more. The flow of sand was unquestionably only an incident to the outflowing of vast quantities of water, the greater part of which disappeared within a few hours after its appearance. The few crevices or "cracks" in the earth which were found were in character and origin similar to the "craters," being long and narrow openings, through which water with sand had been ejected.

It was difficult, in fact quite impossible, to obtain reliable information concerning the nature of this phenomenon at the moment of its occurrence. The locality in which it was principally exhibited is near a station on the South Carolina Railway, between Charleston and Summerville, known as "Ten-mile Hill." It is thinly populated and almost entirely by negroes. Several persons who pretended to have been eye-witnesses of the outburst gave widely different testimony as to its character. According to one account the water and sand from one of the "geysers" spouted to a height greater than that of a telegraph pole and continued to flow for four or five hours. Another, and apparently an equally credible witness, declared that the stream reached a height of six or eight feet, and that the flow continued four or five minutes. The latter statement is probably nearer the truth than the former.

A few instances of sand eruptions were found in the city of Charleston, and a few also at Summerville, and at the latter place water continued to flow from one of the openings for several days after the first shock.

It is important to observe that in no case was it found that the water thus issuing from the earth was hot or noticeably above the temperature of water in shallow wells in the neighborhood. Reports of boiling water having been thrown up were very numerous, but no evidence that the water was really hot appeared. The use of the word "boiling" doubtless grew out of the appearance of the water as it issued from the openings and was probably used by eye-witnesses to describe this appearance with no reference whatever to temperature.

There were also reports of the appearance of blue flames in the neighborhood of these eruptions, but no reliable testimony to their existence could be obtained. There was also a report that was circulated extensively through the medium of the press of the country that two or three showers of hot stones had fallen upon and near the office of the "Charleston News and Courier.". An examination of some of these shortly after they had fallen forced the conviction that the public was being made the victim of a practical joke.

In the city of Charleston about forty lives were lost. The greater number of casualties resulted from injuries sustained by persons who were either in the street at the time of the shock or who rushed out and were caught by the falling débris. No adequate description of the injury to property can be given in this place and, indeed, the results of this earthquake have been so thoroughly considered in the public press that note is unnecessary.

While there was probably not a single house in the city which was not in some degree affected by the shock of August 31st there was naturally great diversity as to the extent of the damage in different localities. Some parts of the city are built upon what is called "made land," resulting in many cases from the filling up of old creek bottoms and from other extensive leveling and grading. A more careful study of these peculiarities and their distribution may lead to the discovery of some relation between local differences in structure and the areas of greatest destruction.

Unquestionably much is to be attributed to the difference in the character of the buildings themselves, and to the relation of their lines of greatest or least strength to the direction of the wave front. As was to be expected, buildings constructed of wood suffered much less than those of brick. The interior of wooden buildings, however, would often exhibit a scene of total destruction, furniture, book-cases, etc., having evidently been moved with great violence. A very brief examination of injured buildings sufficed to establish, in a general way, the principal direction of the movement, which was probably in a northwest and southeast line.

The probability of the destruction of a building depends so largely on conditions other than the amplitude or direction of the vibration of the earth particle that the study of destroyed or damaged structures can yield little exact information concerning these elements. The displacement of bodies of simple form and structure, lying near to or upon the surface of the earth itself, is a vastly more reliable index of the direction and intensity of the disturbance. In the church yards of Charleston many instances of displacement and overturned monuments, columns, urns, etc., were found. These were examined with some care, and a careful study of the results may bring out some information concerning the dynamics of the earthquake. A cemetery containing many pyramidal or cylindrical shafts resting upon flat stone bases is tolerably certain, when disturbed by an earthquake, to exhibit not only displacement but also instances of twisting about a vertical axis; cases of of this kind were numerous at Charleston. Such rotations by no means imply a similar gyratory motion of the earth, as it is well known that they may result, and doubtless always do, from vibratory motions in a single plane. It was not at all uncommon to find two columns, very near to each other, twisted in opposite directions.

The table given below contains a resumé of information received at the office of the Chief Signal Officer from regular observers of the Service and from a number of voluntary observers. The place, time, supposed direction, duration, and estimated intensity are given. Much discrepancy will be observed in the records of time. Confusion is especially great in a few portions of the country in which so called "local time" is still adhered to. Whenever "standard time" is known to have been used reduction has been made to that of the 75th meridian. In a few cases, however, no reasonable supposition will explain the discrepancies. Such records must be erroneous.

A study of this column will show the great importance, in making such observations, of determining the error of the clock or watch at the earliest possible moment by comparison with the time of some known meridian. It must be said, however, that the extended use of standard time has rendered these results vastly more accurate than they otherwise would have been. Telegraphic time-signals are now within the reach of most people, and during the past two or three years a great improvement in the accuracy of time-keeping among the people has taken place.

The direction of the movement recorded against each station is that given by the observer. As it is based in many instances on the motions of swinging objects, or easily movable objects, it is of necessity often erroneous. In the absence of correct instrumental records, however, such observations are of value. The numbers expressing the intensity of the disturbance were applied at this office, from descriptions furnished by obsevers, according to a scale adopted by the Director of the Geological Survey.

This scale is as follows:

No. 1. Very light. Noticed by a few persons; not generally felt.

No. 2. Light. Felt by the majority of persons; rattling windows and crockery.

No. 3. Moderate. Sufficient to set suspended objects, chandeliers, etc., swinging, or to overthrow light objects.

No. 4. Strong. Sufficient to crack the plaster in houses, or to throw down some bricks from chimneys.

No. 5. Severe. Overthrowing chimneys and injuring the walls of houses.

With these intensity numbers an attempt has been made to plot a chart of iso-seismal lines, or lines of equal intensity. The result is shown in chart number vii. Nothing short of the use of well-constructed seismographs can furnish satisfactory measures of the amplitude of vibrations of the earth particle or

the maximum velocity of the same, but in the absence of records of such instruments, this chart or a more perfect one constructed upon the same plan, will afford opportunity for study.

In conclusion, it ought to be stated that this brief review of the Charleston earthquake must be regarded only as an attempt to place some of the leading facts upon record, for the benefit of the readers of the MONTHLY WEATHER REVIEW. It is in no way intended to anticipate the investigations now in progress by the United States Geological Survey, a full report from which, based upon all attainable information, will be looked for with great interest.

Summary of reports from observers.—Earthquake of August 31, 1886.

Station.	Latitude.	Longitude.	Time.	Duration.	Intensity.	Direction.	Observer.
	° ′	° ′	Hour.	Sec.			
Albany, N. Y.*	42 39	73 45	10.01	.....	2	s to nw.	J. O. Barnes.
Arlington, Tenn.*	36 00	86 45	9.50	60	1	n. to s.	W. C. Morris.
Atlanta, Ga	33 45	84 23	9.50	300	4	.....	W. Easby Smith.
Atlantic City, N. J	39 22	74 25	9.55	30	.....	s.	A. J. Mitchell.
Auburn, Ala*	32 38	85 28	8.52	300	3	e. to w.	J. C. Perkins.
Augusta, Ga	33 28	81 54	9.51	90	4	e. to w.	D. Fisher.
Baltimore, Md	39 18	76 37	9.50	60	2	.....	Geo. W. Felger.
Batesville, Miss	34 23	89 50	.....	20	3	n., s.	H. Harris.
Beaver, Ohio	39 00	82 51	.....	30	2	.....	J. M. Grether.
Buchtel, Ohio	39 29	82 15	9.30	120	1	.....	John Maurer.
Cairo, Ill. †	37 00	89 10	9.53	50	2	se. to nw.	C. L. Bozzell.
Cape Henry, N. C	36 56	76 00	9.50	.....	2	.....	Wm. Davis.
Cormit, Miss	.....	.....	9.55	30	.....	.....	T. E. Henry.
Carrollton, Ala	33 15	88 03	8.50	4	3	e. to w.	M. L. Stansel.
Cedar Keys, Fla	29 08	83 02	9.56	105	2	se. to nw.	W. W. Thomas.
Centre, Ala	34 09	85 42	9.00	.....	3	.....	Thos. Bradford.
Charleston, S. C. *	32 47	79 56	9.51	22	5	e. to w.	J. H. Smith.
Charlestown, W. Va	39 18	77 49	9.55	.....	2	.....	New York "Sun."
Chattanooga, Tenn	35 04	85 15	9.50	20	2	e. to w.	"Times."
Do.†	do....	do....	9.53	.....	3	sw. to ne.	Edward A. Beals.
Charlotte, N. C	35 13	80 51	9.54	120	4	.....	James A. Barry.
Cheraw, S. C. *	34 41	79 54	9.50	120	5	w. to e.	W. L. Godfrey.
Chicago, Ill	41 52	87 38	10.00	7	1	w. to e.	Allen Buell.
Chincoteague, Va	37 55	75 23	.....	.....	2	.....	A. B. Crane.
Do	do....	do....	10.36	.....	1	.....	
Cincinnati, Ohio	39 06	84 30	9.13	.....	1	.....	P. T. Jenkins.
Cleveland, Ohio	41 30	81 42	9.54	.....	1	.....	Wm. Line.
Columbia, S. C	34 00	81 06	9.51	.....	5	.....	Robert W. Shand.
Columbus, Ohio *	39 58	83 00	9.53	105	2	n. to s.	H. B. Gill.
Do	do....	do....	9.52	.....	1	nw. to se.	A. L. McRae.
Columbus, Ga	32 27	84 54	9.56	46	3	..	"Enquirer-Sun."
Covington, Tenn	35 36	89 36	9.55	3	1	.....	D. T. Flannery.
Connersville, Ind	39 33	85 05	9.52	25	3	n. to s.	Robert Hessler.
Dale Enterprise, Va.*	38 30	78 42	9.55	.....	3	e. to w.	L. J. Heathwole.
Danville, Va	36 36	79 24	10.05	.....	.....	.....	"Daily Dispatch."
Davenport, Iowa	41 30	90 38	10.00	1	1	se. to nw.	Robert R. Marten.
Decatur, Ala	34 35	86 55	9.53	.....	.....	se. to nw.	A. C. Frey.
Detroit, Mich	42 20	83 03	9.58	.....	1	.....	H. McP. Baldwin.
Do	do....	do....	9.58	15	1	.....	N. B. Conger.
Diamond, Ga	34 41	84 15	.....	.....	4	.....	W. W. Kingey.
Dubuque, Iowa	42 30	90 44	9.02	10	1	.....	S. E. Emery.
Dyersburg, Tenn	36 03	89 24	9.54	10	3	ssw.	Louis Hughes.
Do	do....	do....	.....	.....	3	n. to s.	S. G. Parker.
Enfield, N. C.†	36 10	77 40	.....	18	3	....	John Goodrich.
Elberton, Ga	34 04	82 48	.....	10	3	w. to e.	Louis Dorman.
Florence, Ala	34 48	87 38	9.10	10	1	.....	J. W. Milner.
Fort Macon, N. C	34 42	76 40	9.43	25	2	s., sw.	Wm. Daly.
Gainesville, Ga.*	34 22	83 48	9.15	45	4	w. to e.	C. B. La Hatte.
Grand Haven, Mich	43 05	86 18	9.40	5	1	e. to w.	Joseph E. Mueller.
Grand Junction, Tenn	35 04	89 10	9.55	.....	2	.....	J. B. Irwin.
Greensborough, Ala	32 43	87 36	9.	.....	2	.....	"Daily Dispatch."
Gloversville, N. Y	43 03	74 22	10.00	.....	2	se. to nw.	L. W. Chamberlin.
Hartford, Conn.*	41 31	72 21	9.54	.....	3	.....	A. H. Eddy.
Hatteras, N. C	35 15	75 40	10.00	60	3	sw. to ne.	Arthur S. White.
Hollow (?) Springs, Tenn	36 36	86 22	10.00	60	1	.....	N. F. Bryant.
Indianapolis, Ind.*	39 46	86 10	9.55	8	2	.....	C. F. R. Wappenhans.
Ithaca, N. Y	42 24	76 36	9.55	.....	2	.....	"New York Tribune."
Jacksonville, Fla	30 20	81 39	8.45	.....	2	.....	New York "Sun."
Do	do. ..	do....	9.52	90	3	e. to w.	J. W. Smith.
Kitty Hawk, N. C	36 00	75 42	10.00	5	.....	.....	P. W. Fitzmaurice.
Knoxville, Tenn.†	35 56	83 58	9.55	30	2	e. to w.	W. O. Bailey.
Lincoln, Ohio †	38 45	82 19	.....	10	2	s.	M. M. Walter.
Lincolnton, N. C	35 29	81 12	9.55	75	3	.....	Dr. L. R. Standemeyer.
London, Ont	42 59	81 15	.....	30	2	.....	"New York Herald."
Louisville, Ky	38 15	85 45	9.13	.....	2	se. to nw.	Frank Burke.
Lynchburg, Va	37 25	79 09	9.50	.....	2	.....	"Daily Dispatch."
Do	do..	do....	9.55	120	3	.....	Thos. S. Schley.
Mansfield, Ohio	40 46	82 29	9.30	.....	1	.....	"Daily Dispatch."
Mapleton, S. C.*	33 51	82 19	.. ..	180	5	.....	Wm. Bradley.
Manington, Ky	.....	.....	9.15	60	1	.....	J. H. Allen.
Memphis, Tenn	35 09	90 03	.....	20	3	.....	
Do.*	do....	do....	9.55	10	2	ne. to sw.	D. T. Flannery.
Do	do....	do....	9.55	7	3	.....	F. Zimmerman.
Do	do....	do....	.....	.....	.....	e. to w.	Christian Bros. College.
Do	do....	do....	9.57	.....	3	.....	J. P. Young.
Do	do....	do....	9.55	20	3	e. to w.	W. Harvey.
Do	do....	do....	9.58	10	2	w. to e.	E. Lippencott.
Do	do....	do....	9.55	....	2	w. to e.	R. G. Latting.
Do	do....	do....	.....	60	.....	w. to s.	A. G. Watts.
Do	do....	do....	.....	30	.....	ne. to sw.	O. M. Peck.
Do.*	do....	do....	.....	20	2	.....	W. H. Stillwell.
Do	do.	do....	9.50	90	1	se. to nw.	Don. Wishart.
Milan, Tenn	35 56	88 58	9.57	.....	3	sw. to nw.	O. F. Cantwell.
Mobile, Ala	30 41	88 02	.....	.....	1	.....	A. Pritchard.
Montgomery, Ala	32 23	86 18	9.56	32	3	se. to nw.	L. Dunne.
Do	do....	do....	9.55	.. ..	2	.....	"Daily Dispatch."

Summary of reports from observers—Continued.

Station.	Latitude.	Longitude.	Time.	Duration.	Intensity.	Direction.	Observer.
	° ′	° ′	Hour.	Sec.			
Morristown, N. J	40 48	74 27	9.55	25	2	se. to nw.	Thos. J. Beans.
Mossy Creek, Ga	34 36	83 42	.....	840	1	.....	J. M. Dorsey.
Murphysborough, Ill	37 50	89 21	.....	.....	2	.....	
Nashville, Tenn	36 10	86 47	9.54 30	60	2	n., e.	L. N. Jesunofsky.
New Haven, Conn	41 18	72 50	9.55 30	.....	1	.....	J. H. Sherman.
New London, Conn	41 21	72 05	.....	.....	.....	.....	W. A. Olds.
New River, N. C.†..	.....	.....	9.50	.....	.....	.....	E. E. Perry.
New York City	40 43	74 00	9.55	60	3	.....	S. H. Hurd.
Do	do....	do....	9.53	60	2	nw., se.	H. J. Penrod.
Norfolk, Va	36 51	76 17	9.45	90	2	.....	"Daily Dispatch."
Do	do....	do....	9.54	15	3	e. to n.	James P. Sherry.
Do	do....	do....	.....	35	1	s., sw.	J. H. Teerney.
Norwood, N. C.†	35 15	80 03	9.30	120	4	e.	J. W. Wright.
Oawiches, Ala	32 10	85 00	9.00	.....	2	.....	W. C. Whitaker.
Opelika, Ala.*	32 38	85 23	9.55	20	4	.....	G. E. Webber.
Oxford, Miss	34 20	89 26	9.57	60	2	e. to w.	"University."
Paducah, Ky	37 05	88 36	.....	15	.....	.....	
Paris, Tenn.†.	36 18	88 21	9.56	60	.....	sw. to ne.	J. P. Chambers.
Do	do....	do....	9.56	30	.....	.....	E. P. Wood. C. A. Davis.
Pensacola, Fla	30 25	87 13	10.00	30	1	.....	W. L. Widmeyer.
Petersburg, Va	37 14	77 22	10.(?)	.....	2	.....	"Daily Dispatch."
Petrolea, Ont	42 51	82 09	.....	.....	1	.....	"New York Herald."
Philadelphia, Pa	39 57	75 09	9.50	60	2	e. to w.	L. W. Dey.
Pittsburg, Pa	40 32	80 02	9.55	60	1	.....	O. D. Stewart.
Pekin, Ill	40 35	89 39	.....	.....	1	.....	J. E. Terborg.
Plainfield, N. J	40 14	74 25	9.56	.....	2	n. to s.	"Daily Dispatch."
Plum Branch, S. C.*	.....	.....	.....	600	3	nw. to ne.	S. E. Freeland.
Port Huron, Mich	42 58	82 29	9 55	.....	1	.....	W. M. Edmondson.
Raleigh, N. C	35 46	78 39	9.50	.....	2	.....	New York "Sun."
Do.*	do....	do....	9.50	120	5	.....	Thos. C. Harris.
Do	do. ..	do....	10.06	30	3	.....	Thos. C. Harris.
Rassetter, Fla	28 58	81 22	.....	.....	2	.....	H. V. Nosgky.
Rappahannock Station, Va*	38 30	77 45	.....	30	3	e. to w. se. to sw.	W. H. Ireland.
Richmond, Va	37 32	77 22	9.55	.....	2	.....	"Daily Dispatch."
Rockland, Ohio	39 17	81 36	.....	.....	2	.....	T. V. McTaggart.
Rutherfordton, N. C.†.	35 24	81 50	9.50	150	4	.....	Albert L. Grayson.
Sandy Hook, N. J	40 28	74 01	9.45	60	.....	ne. to sw.	Frank Ridgway.
Sanford, Fla	28 48	81 23	9.50	10	3	w. to e.	Henry Pennywitt.
Savannah, Ga.†	32 05	81 08	9.52	75	4	sw. to ne.	Richard Graham.
Saulsbury, Tenn	35 03	89 02	.....	20	2	se. to w.	R. M. Bostwick.
Scottsborough, Ala	34 38	86 00	.....	.....	2	se. to nw.	W. A. Anderson.
Selma, Ala	32 24	87 00	9.00	.	2	e. to w.	"Daily Dispatch."
Smithville, N. C*	33 55	78 01	9.50	10	4	nw. to se.	F. P. Chaffee.
Somerset, Ky	37 06	84 42	9.59	60	2	w. to e.	S. Whenery.
Soapstone, N. C	35 48	79 36	.....	.....	3	.....	H. L. Kinney.
Saint Louis, Mo	38 38	90 12	8.20	.....	1	.....	"Globe Democrat."
Do.*	do....	do....	9.25	.....	1	.....	G. A. Webber.
Toledo, Ohio	41 40	83 32	9.20	.....	1	.....	A. E. Fraser.
Tracy City, Tenn	35 16	85 48	9.50	.....	3	w. to e.	W. T. Thomas.
Triangle, S. C.†	33 30	80 20	.....	.....	4	.....	Wm. B. Smith.
Tuskegee, Ala	32 20	85 39	8.30	60	2	.....	"Daily Dispatch."
Union Springs, Ala	32 07	85 43	9.00	30	2	.....	J. L. Moultrie.
Valley Head, Ala	34 36	85 36	9.00	60	.....	.....	E. P. Nickolson.
Vevay, Ind	38 45	85 03	9.10	.....	.....	ne. to sw.	Charles G. Boerner.
Do	do....	do....	9.25	....	.....	.....	
Do.*	do....	do....	9.45	.....	3	.....	
Vicksburg, Miss	32 23	90 54	10.05	45	3	e. to n.	John W. Byram.
Walthourville, Ga	31 46	81 36	9.30	75	4	s. or se.	John L. Harden.
Washington City	38 53	77 01	9.55	40	.....	n. to s.	T. B. Harrison.
Do*	do....	do....	9.53	23	4	n. to s.	Alex. McAdie.
Wetumpka, Ala	32 32	86 13	9.00	.....	3	.....	"Daily Dispatch."
Weldon, N. C	36 27	77 38	9.50	.....	.....	.....	F. A. Clark.
Willow Grove, W. Va	38 54	81 54	9.32	.....	2	.....	J. N. Trimble.
Wilmington, N. C	34 11	78 10	9.50	25	3	nw.	W. H. Fallon.
Woodbury, N. J	39 39	75 18	9.57	6	.....	.....	Edward Brown.

* Accompanied by noise. † Preceded by noise.

In addition to the above earthquake in the United States on the 31st, the following reports have been received:

Indianapolis, Indiana: a slight earthquake shock was felt here on the afternoon of the 13th. The motion continued about twelve seconds.

The following is from the "New York Herald" of August 13th:

QUEBEC, *August* 12, 1886.—Early on Wednesday morning a sharp shock of earthquake was felt at Ste. Marguerite, Ste. Adèle, and St. Sauveur. A barn at the first named place was shaken down, and other buildings were slightly damaged. The shocks lasted about six minutes. A violent wind and hail storm prevailed at the time.

The following is from the "New York Tribune" of August 16th:

LONDON, *August* 16.—Three shocks of earthquake were felt in Malta yesterday at intervals of eight hours. No daamge was done, but the people were greatly alarmed.

The following is from the "Erie Morning Dispatch" of August 21st:

LONDON, *August* 16.—Three shocks of earthquake has been felt at Malta. The captain of a steamer which has arrived there reports that on Tuesday, two hundred miles east of Malta, he witnessed the upheaval of a column of water thirty feet in diameter to a distance of two hundred feet.

The following is from the "New York Tribune" of August 22d:

EDINBURGH, *August* 21.—Kilsyth, in Sterling county, Scotland, was visited to-day by a shock of earthquake. The shock was slight.

The following reports are from the "New York World" of August 29th:

ALEXANDRIA, *August* 28.—Violent shocks of earthquake have been experienced here and in other parts of Egypt, causing terror among the natives, but so far as known doing no serious damage.

ROME, *August* 28.—Several towns in Italy were also visited by the earthquake, but not to any serious extent, Naples, Brindisi, Foggia, Caserta, and Taranto being of the number. Later despatches say that among the towns in Italy where the earthquake was felt are Syracuse, Reggio, Calabria, Potenza, Pozzuoli, Bari, and Avellino. The people were panic stricken, and took refuge in the fields and churches.

The following reports of earthquake are from the "New York Herald" of August 30th:

NAPLES *August* 29, 1886.—Vesuvius is again in a state of eruption. The people of Naples and Bari are fleeing to the country or gathering in the open spaces.

ATHENS, *August* 29, 1886.—The area of the earth disturbance in Greece yesterday was phenomenally wide. At least six towns were entirely destroyed and score of others were partially destroyed. On the mainland much damage was done, but there was little loss of life. On the islands it is estimated that six hundred persons were killed and one thousand seriously injured. The undulations were curiously regular. The actual shocks averaged twelve seconds in duration.

FOREST AND PRAIRIE FIRES.

Forest City, Potter county, Dakota: during the 1st, 2d, and 3d prairie fires were burning in this county. The fire burned over twenty miles of the Missouri River bottom lands and destroyed much agricultural property.

Escanaba, Michigan: on the 8th, 9th, 10th, and 11th disastrous forest fires were burning at Stevenson, thirty miles southwest of this town. At 4 p. m. of the 8th the smoke became so dense at Escanaba that the sun was completely hidden from view, as it was also during the greater part of the 9th. On the 10th the fires were burning along the line of the Chicago and Northwestern Railroad.

Cheboygan, Cheboygan county, Michigan, 9th: the forest that nearly surrounds the town is burning rapidly and the sky is overcast with smoke.

Fort Assinaboine, Montana: from the 9th to the 26th prairie fires in this vicinity burned over an area of not less than four hundred square miles of the best grazing land in Montana, and destroyed much valuable pine timber in the Bear Paw and Little Rocky Mountains. On the 26th light rain fell from 2.40 to 7.22 p. m., extinguishing the fires.

Traverse City, Michigan: on the 11th destructive forest fires were burning near this place and along the line of the Central Railroad, from Bay City to Mackinaw. Fences, farm houses, saw-mills, and millions of feet of lumber have been burned, The fire extended over a large area, including Calmut, Clark, and Marathon counties; in these counties hundreds of families are reported to have been made homeless by the fires.

Milwaukee, Wisconsin, 16th: during the past week very disastrous forest fires have been burning in northern and middle Wisconsin. The greatest damage was to standing timber, which is the source of wealth in this district. The drought has continued so long that leaves have withered and fallen weeks before their usual time, swamps and marshes have dried, creeks have disappeared, and larger streams are reduced in size. Everything, therefore, is perfectly dry and the fire spreads, with nothing to impede its progress.

Oconto, Oconto county, Wisconsin, 16th: during the past week disastrous forest fires have been burning along the line of the Chicago and Northwestern Railroad. The fire consumes the underbrush and dead trees and kills the green ones. Many hundreds of acres of forest have been destroyed. A number of farm houses and barns have been burned. North of the town of Velp, and toward the northwest over an area twelve miles wide, the woods are burning rapidly; owing to the fact that this forest was burned over by a former fire which killed the green trees but did not consume them, this fire spread with unusual rapidity, destroying numerous farm houses and compelling the occupants to remove their household effects to the centre of ploughed fields for safety. In the vicinity of Big Suamico, near Green Bay, farmers have lost nearly all their property, the fire destroying fences, barns, and stacks of hay and wheat. In Eaton township twenty-seven houses were burned. It is estimated that property to the amount of $200,000, not including the value of the timber, has been destroyed in Brown county alone. From the village of De Pere the fire extended toward the north for miles, burning dwellings, saw-mills and barns. Owing to the long drought all underbrush was very dry, allowing the fire to spread rapidly.

Genoa, Platte county, Nebraska: the observer at this place makes the following report in reference to the state of the atmosphere on the 26th, 27th, and 28th:

About 7 p. m. of the 26th the wind veered suddenly from the south to north and northwest, and rolled over the town a dense cloud of what proved to be smoke, having the peculiar smell of burning vegetation; this smokiness of the atmosphere continued during the 27th and 28th. No fires have occurred in this vicinity, and therefore the smoke must have proceeded from the burning forests in Wisconsin.

East Portland, Oregon: throughout the month the atmosphere has been filled with smoke from forest fires; 2,000 cords of wood were burned, as well as many acres of valuable forest.

Forest and prairie fires have also been reported from the following places:

Marquette, Michigan: forest fires, 8th to 11th.
Mount Angel, Oregon: forest fire, 4th.
Portland, Oregon: forest fires, 1st, 3d, 4th, 5th, 11th, 27th.
Philipsburg, Pennsylvania: forest fire, 21st.
Embarras, Wisconsin: forest fire, 3d.
San Antonio, Texas: prairie fire, 3d.
Moorhead, Minnesota: prairie fire, 28th.
Saint Vincent, Minnesota: prairie fires, 25th, 26th, 28th, 31st.
Fort Buford, Dakota: prairie fires, 19th, 20th.
Yankton, Dakota: prairie fires, 28th, 29th.
Huron, Dakota: prairie fires, 27th, 28th.
Fort Shaw, Montana: prairie fire, 24th.
Poplar River, Montana: prairie fires, 18th, 19th, 21st.
Fort Maginnis, Montana: forest fires, 22d, 28th.
Fort Cœur d'Alene, Idaho: forest fires, 16th, 17th, 18th, 20th, 24th.
Boisé City, Idaho: forest fires, 21st, 22d.
Walla Walla, Washington Territory: forest fires, 19th.
Fort Reno, Indian Territory: prairie fires, 15th, 26th, 27th.

METEORS.

Variety Mills, Nelson county, Virginia: on the 2d, at 9 p. m., a very bright meteor, followed by a long train, passed across the sky near the zenith, from north-northeast to south-southwest.

Nicolaus, Sutter county, California: at 7.30 p. m. of the 3d a meteor of the apparent size of a bucket passed from the south directly over the town. Balls of fire and sparks were constantly dropping from the meteor; it was followed by a brilliant train.

Moorestown, New Jersey: on the 26th, at 8.04 p. m., a meteor, four times the size of Venus, passed from the west of Ursa Major and burst into two fragments and disappeared when in constellation Cassiopeia.

Beverly, Burlington county, New Jersey: on the 26th, at 8.03 p. m., a white meteor, about half the size of the new moon, passed from west to east at an average altitude of 80°. The meteor was visible about five seconds and disappeared in the east. This meteor was also seen at Haddonfield, Clayton, and Woodbury, New Jersey.

Mobile, Alabama: about 9.45 p. m. of the 31st a very brilliant meteoric display was observed in the western horizon; it passed across the sky from east to west, appearing at intervals in the form of a ball of fire. The display continued about forty-five seconds.

Meteors were also reported, as follows:

California.—Fort Bidwell, 4th.

Dakota.—Webster, 10th, 11th, 25th, 29th, 30th.
Florida.—Key West, 1st; Limona, 2d, 17th, 18th, 19th, 23d; Archer, 10th, 18th, 22d, 27th, 28th; Alva, 10th, 19th, 20th, 21st.
Illinois.—Charleston, 19th, 22d, 25th, 28th; Windsor, 27th.
Indiana.—Vevay, 25th, 26th.
Iowa.—Davenport, 6th, 8th, 9th, 15th, 24th, 26th.
Kansas.—Allison, 3d to 31st; Topeka and Wilmington, 10th.
Maryland.—Fallston, 20th; Fort McHenry, 21st; Woodstock, 23d; Baltimore, 26th.
Massachusetts.—Cottage City, 11th; Somerset, 23d.
Michigan.—Mackinaw City, 1st; Kalamazoo, 2d, 7th, 11th, 25th, 27th, 28th, 30th.
New Hampshire.—Nashua, 10th.
New Jersey.—Egg Harbor City, 2d, 3d; Clayton, 3d, 23d; Beverly, 9th, 10th; Dover, 20th, 28th, 29th; Upper Montclair, 30th.
New York.—North Volney, 3d; Mountainville, 3d, 4th, 17th, 23d; Albany, 10th.
Ohio.—Napoleon, 10th; Jacksonborough, 28th.
Oregon.—Mount Angel, 10th.
Pennsylvania.—Pittsburg, 21st; Dyberry, 26th.
South Carolina.—Stateburg, 3d; Spartanburg, 28th; Aiken, 30th.
Texas.—Cleburne, 7th, 10th, 16th, 17th, 18th, 21st to 24th, 28th.
Vermont.—Strafford, 4th.
Virginia.—Chincoteague, 2d, 13th; Variety Mills, 2d; Dale Enterprise, 26th; Rappahannock, Station, 9th, 12th, 16th, 18th.

POLAR BANDS.

Polar bands were reported during the month from the following stations:
Archer, Florida, 1st, 2d, 6th, 31st.
Riley, Illinois, 15th, 21st.
Salina, Kansas, 19th, 22d, 24th.
Beverly, New Jersey, 4th.
Napoleon, Ohio, 8th.
Wauseon, Ohio, 18th.
Wytheville, Virginia, 2d, 3d, 13th.
Prairie du Chien, Wisconsin, 17th.

SAND STORMS.

Fort McDowell, Arizona, 10th, 13th, 22d, 24th.
Yuma, Arizona, 25th.

SUN SPOTS.

Prof. David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for August, 1886:

Date—August, 1886. Standard time.	No. of new.		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 3 p. m...	1	3	0	0	1	3	4	30‡	
2, 4 p. m...	0	4	2	5‡	.....	.....	3	45‡	
6, 9 a. m...	.....	.....	.....	.....	.....	.....	2	35‡	
8, 2 p. m...	.....	.....	.....	.....	.....	.....	1	5	
9, 5 p. m...	0	0	0	0	0	0	1	5	
10, 7 p. m...	0	0	0	0	0	0	1	4	
11, 4 p. m...	1	4	0	3	1	4	2	5	
12, 3 p. m...	0	0	1	1	0	0	1	4	
14, 10 a. m...	0	0	0	0	0	0	1	4	
15, 5 p. m...	0	0	0	0	0	0	1	3	
17, 9 a. m...	0	0	0	0	0	0	1	3	
18, 5 p. m...	1	3	0	0	0	0	2	6	
20, 4 p. m...	1	1	.....	.....	0	0	2	2	
21, 6 p. m...	1	1	0	0	1	1	1	1	Small spot.
22, 3 p. m...	1	1	0	0	1	1	1	1	Small spot.
23, 7 a. m...	0	0	0	0	0	0	1	1	Small spot.
24, 12 m....	0	2	0	0	0	0	1	3	Small spots.
26, 11 a. m...	0	10‡	0	0	0	0	1	13‡	
27, 4 p. m...	0	12‡	0	0	0	0	1	25‡	
28, 5 p. m...	0	5‡	0	0	0	0	1	30‡	
29, 6 a. m...	0	0	0	0	0	0	1	15‡	
29, 3 p. m...	0	0	0	0	0	0	1	10‡	

Faculæ were seen at the time of every observation. ‡Approximated.

Mr. H. D. Gowey, of North Lewisburg, Champaign county, Ohio, reports having observed sun spots on the following dates: 1st to 4th, 6th, 7th, 9th, 10th, 11th, 13th, 18th, 19th, 26th, 27th, 31st.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and sixty stations show 4,948 observations to have been made, of which five were reported doubtful; of the remainder, 4,943, there were 4,298, or 87.0 per cent., followed by the expected weather.

RED SUNSETS.

The following description of red sunsets is furnished by Prof. Cleveland Abbe, Assistant:

Red sunsets have been frequently looked for by me during July and August, 1886, but the following is the only case that has been noted:

August 21, 1886, on board steamer "G. W. Leary," steaming northward in middle of lower Chesapeake Bay, latitude N. 37° 10′, longitude W. 0° 50′ from Washington City, sunset clouds a few degrees high (watch about three minutes fast on Eastern time, and this correction applied to my record); 7 h. 0 m., suspected pink; 7 h. 3 m., decided pink glow, maximum altitude 15°; 7 h. 7 m., very rich yellow, and brightness generally increased, but pink rapidly fading; 7 h. 12 m., no pink visible, but pale salmon tint up to 8° altitude. August 22d, 23d, and 24th, in Washington City, suspected pink for a few minutes but no decided tint.

WATER-SPOUTS.

Pensacola, Florida: a water-spout was visible from the city at 6.30 a. m. of the 17th, near Santa Rosa Island in the Gulf. It resembled a solid column of dense black cloud, extending from the sky to the water. At one time the spout attained the diameter of forty feet. The phenomenon lasted about half an hour, during which time it assumed various forms.

The schooner "Nelson Bartlett," Capt. S. Watts, commanding, on the 22d, at 12 noon (Greenwich mean time), in N. 8° 02′, W. 47° 17′, passed two water-spouts; wind south, weather clear.

Capt. Samuel Adamson, commanding the s. s. "Joshua Nicholson," reports having observed on August 28th, at 6 p. m. (Greenwich mean time), an immense water-spout off the north end of Fayal, Azores, which seemed to touch the north end of the island; it was accompanied with moderate squalls and torrents of rain, and was distant fifteen miles sse. of the vessel. The brig "Lilian," Capt. H. F. Schive, commanding, passed a heavy water-spout on the 5th, in N. 12° 50′, W. 57° 30′; wind strong from se., with rain.

VERIFICATIONS.

INDICATIONS.

The indications for August, 1886, were made by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant. The indications for the first twenty-five days of August, 1886, were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant; the remaining six days, by 2d Lieutenant J. P. Finley, Signal Corps, U. S. Army, Assistant.

The detailed comparison of the tri-daily indications for August, 1886, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 75.36. The percentages for the different elements are: Weather, 74.22; wind, 70.78; temperature, 77.92. By states, etc., the percentages are: For Maine, 71.45; New Hampshire, 71.80; Vermont, 70.48; Massachusetts, 71.45; Rhode Island, 77.07; Connecticut, 75.59; New York, 77.31; Pennsylvania, 79.96; New Jersey, 81.16; Delaware, 75.54; Maryland, 79.28; District of Columbia, 78.63; Virginia, 75.73; North Carolina, 75.72; South Carolina, 73.31; Georgia, 73.65; Florida, 73.82; Alabama, 75.24; Mississippi, 72.88; Louisiana, 78.41; Texas, 86.48; Arkansas, 73.63; Tennessee, 66.88; Kentucky, 71.21; Ohio, 80.11; West Virginia, 79.01; Indiana, 75.70; Illinois, 77.33; Michigan, 82.04; Wisconsin, 74.48; Minnesota, 72.99; Iowa, 71.51; Kansas, 76.22; Nebraska, 69.49; Missouri, 76.18; Colorado, 62.34; east Dakota, 66.29.

There were three omissions to predict, out of 9,951, or 0.03 per cent. Of the 9,948 predictions that have been made, six hundred and sixty-three, or 6.66 per cent., are considered to have entirely failed; six hundred and two, or 6.05 per cent., were one-fourth verified; 1,858, or 18.68 per cent., were one-

half verified; 2,049, or 20.60 per cent., were three-fourths verified; 4,776, or 48.01 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During August, 1886, thirty-eight signals of various kinds were ordered, of which number, thirteen, or 34.21 per cent., were fully justified both as to direction and velocity. Of the above signals, seven were ordered for northeasterly winds; of these, four, or 57.14 per cent., were justified both as to direction and velocity, and five, or 71.42 per cent., were justified as to velocity only. Thirty-one signals were ordered for winds without regard to direction; of these, twenty-two, or 70.97 per cent., were not verified, and nine, or 29.03 per cent., were verified.

In twenty-one cases winds occurred which would have justified cautionary signals had they been displayed, and in eleven cases winds occurred which would have justified the display of on-shore signals.

RAILWAY WEATHER SIGNALS.

Prof. P. H. Mell, jr., director of the "Alabama Weather Service," in the report for August, 1886, states:

The verification of predictions for the whole area was 92.7 per cent. for temperature, and 75 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus and Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; the cities of Milledgeville, Georgia, and Talladega, Alabama.

LOCAL WEATHER SIGNALS.

Prof. Goodwin D. Swezey, director of the "Nebraska Weather Service," in the report for August, 1886, makes the percentage of verifications for temperature in the state 85.0, and weather 71.7.

Prof. Winslow Upton, director of the "New England Meteorological Society," in the report for August, 1886, states:

The verification of weather signals at New Haven was 84 per cent. for temperature, 74 for weather; at fourteen other stations reporting to the secretary, 87.1 for temperature, 79.9 for weather. Predictions at Blue Hill for twenty-four hours from sunset were 81 per cent. verified, and for sixteen hours from 8 a. m. 84 per cent. verified. It should be noted that no rules have been adopted for verifying predictions, and these returns are not strictly comparable.

ERRATA.

In the REVIEW for July, 1886, on page 185, under "Precipitation," in the lines "The distribution of rainfall over the United States and Canada for June, 1886," instead of "June" read July. In the same REVIEW on page 190, under "Cotton region reports," in the third line, instead of "June" read July. On page 202, in the "Meteorological record of voluntary observers and Army post surgeons," under Alabama, instead of "Birmingham" read Greensborough.

Meteorological record of voluntary observers and Army post surgeons, August, 1886.

The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
Alabama.	°	°	°	*Inches*
Greensborough	94	67	79.0	7.31
Mount Vernon B'ks	102	64	82.2	6.90
Arizona.				
Huachuca, Fort	97	55	75.0	4.24
Lowell, Fort	111	67	86.4	1.24
McDowell, Fort	116	64	92.2	2.04
Arkansas.				
Lead Hill *	109	53	81.0	3.91
British Columbia.				
New Westminster	83	49	64.4	1.60
California.				
Alcatraz Island	69	48	55.5	0.00
Anderson	107	62	80.0	0.00
Angel Island	84	52	62.1	0.00
Benicia Barracks	94	55	69.8	0.00
California—Cont'd.				
Bidwell, Fort	96	39	72.5	0.04
Cahuenga				0.16
Gaston, Fort	104	38	70.9	0.00
Hydesville				0.00
Mason, Fort	84	54	62.3	0.00
Nicolaus	101	58	78.2	trace
Oakland	81	54	61.2	0.00
Oroville	98	62	80.2	trace
Poway	98	64	74.2	0.02
Presidio of San F	75	47	58.0	0.00
Princeton	105	50	76.6	trace
Sacramento	99	49	72.2	0.00
Salinas	78	54	59.6	0.00
Santa Barbara	85	53	68.2	trace
Susanville	97	68	72.0	0.03

Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
Colorado.	°	°	°	*Inches*
Colorado Springs	89	45	68.9	1.39
Lewis, Fort	88	39	64.9	3.99
Connecticut.				
Hartford	88	42	68.3	3.33
North Colebrook	88	35	64.2	1.51
Southington	90	49	67.9	2.35
Dakota.				
Abr. Lincoln, Fort	109	32	70.8	1.90
Meade, Fort	103	32	77.9	1.50
Pembina, Fort	101	34	65.9	0.25
Randall, Fort	101	30	75.7	4.25
Richardton	106	36	69.8	1.40
Sisseton, Fort	100	29	69.7	1.60
Sully, Fort	110	39	77.0	1 15
Totten, Fort	105	33	69.4	0.89
Webster	106	31	71.8	2.36
Yates, Fort	106	27	74.1	3.21
District of Columbia.				
Distributing Res'r*	90	58	75.8	1.58
Receiving Res'v'r*	90	61	75.6	1.07
Rock Creek Bridge*	93	60	77.1	
Florida.				
Alva*	95	70	78.4	9.55
Archer *	97	69	81.9	8.50
Limona *	102	72	83.7	8.91
Manatee	95	75	83.5	11.43
Meade, Fort				10.50
Merritt's Island	92	69	79.9	4.21
St. Augustine, Fort	92	69	79.3	6.70
Tallahassee *	94	70		7.75
Georgia.				
Athens	94	60	76.6	2.78
Forsyth *	98	68	79.7	3.49
Milledgeville	96	62	80.0	5.54
Idaho.				
Boisé Barracks	102	50	79.1	trace
Cœur d'Alene, Fort	95	41	67.6	0.04
Illinois.				
Anna *	98	51	77.9	2.63
Bunker Hill				2.94
Bloomington	94	58		1.73
Collinsville	101	51	76.8	3.45
Charleston*	102	50	76.1	2.90
Geneseo *	97	43	75.3	0.83
Mattoon *	102	58	77.0	3.30
Pekin *	99	47	77.4	5.53
Peoria	99	52	78.8	3.30
Riley	93	45	69.6	8.85
Rockford*	90	50	71.0	8.41
Sandwich	96	52	73.7	3.01
South Evanston	96	44		3.58
Sycamore	96	44	70.2	4.29
Windsor	100	48	76.3	3.08
Indian Territory.				
Gibson, Fort	105	52	80.3	3.00
Reno, Fort	108	58	83.2	0.34
Supply, Fort	104	55	79.8	0.92
Indiana.				
Butlerville *	95	55	75.0	6.00
Fort Wayne*	90	47	72.0	4.41
Connersville	87	58	70.8	7.43
Jeffersonville	93	55	75.3	5.16
Laconia	97	53	75.7	3.35
Lafayette	97	44	74.0	4.46
La Grange	90	42	70.5	5.70
Logansport*	98	52	74.4	6.30
Mauzy	88	44	69.2	7.31
Spiceland	91	48	70.6	6.88
Sunman*	90	50	73.8	7.38
Terre Haute*	91	60		3.40
Vevay	93	55	74.9	3.18
Iowa.				
Bancroft	98	34	72.8	1.66
Cedar Rapids *	96	40	78.5	1.70
Corydon	102	57	79.0	2.10
Des Moines	100	42	75.5	
Fort Madison	96	55		6.60
Independence *	94	52	73.4	1.12
Logan	100	48	76 8	2.20
Manchester*	98	43	75.1	0.70
Monticello *	99	40	73.5	2.38
Muscatine	100	47	75.4	2.62
Oskaloosa a*		58	74.1	1.11
Oskaloosa b*	95	47		
Urbano	103	54	75.5	0.53
Kansas.				
Allison	108	49	77.5	1.13
Atchison *	105	54	79.4	1.76
Belleville	101			1.64
Emporia	102	56	78.8	2.49
Hays, Fort	102	48	75.9	2.41
Independence *	104	58	78.4	4.25
Lawrence	105	52	79.0	2.49
Manhattans	105	60	78.8	2.01
Manhattan b	110	49	78.7	2.06
Riley, Fort	104	54	79.9	1.38
Salina	102	60	80.7	4.00
Sterling	102	58	76.7	4.77
Topeka	107	54	80.5	3.03
Wellington	100	55	78.6	2.96
West Leavenworth	110	53		1.00
Westmoreland*	105	50	79.0	0.75
Kansas—Cont'd.				
Wyandotte	108	48	71.0	1.30
Yates Centre	99	49	70.5	3.57
Kentucky.				
Bowling Green	95	60		
Frankfort	92	53	75.4	4.35
Louisiana.				
Grand Coteau	95	72	82.0	1.62
Liberty Hill	94	71	87.5	4.31
Luling *	94	65	79.9	1.09
Maine.				
Bar Harbor	90	47		1.44
Cornish *	90	49	65.8	4.08
Gardiner	87	47	64.7	2.82
Orono *	90	43	65.6	2.27
Maryland.				
Cumberland	88	50	70.5	3.25
Fallston*	89	54	70.9	4.53
Great Falls*	94	55	74.3	1.03
McDonogh	89	54	74.4	0.83
McHenry, Fort	85	58	72.3	3.74
Woodstock	89	50	71.0	2.21
Massachusetts.				
Amherst a	90	39	66.3	2.60
Amherst b	88	50	67.3	2.92
Blue Hill Obs'y	88	50	65.4	3.95
Dudley	92	40	70.2	3.04
Fall River	85	46	66.6	4.18
Fitchburg	90	51	67.4	3.15
Heath	90	50		
Milton	85	43	64.3	3.29
New Bedford	84	48	66.6	2.95
Princeton	90	47	65.1	3.18
Somerset *	92	47	70.4	3.53
Taunton	92	45	67.5	3.81
Westborough	95	38	70.0	4.41
Worcester	83	51	66.1	3.81
Michigan.				
Brady, Fort	92	36	64.5	1.42
Harrisville*	91	34		4.33
Hudson	92	36		4.60
Kalamazoo	86	51	68.5	4.67
Lansing	80	38	68.5	5.70
Mottville	92	50		2.88
Pentwater	93	32	66.2	4.58
Thornville	92	49	69.9	3.25
Traverse City *	95	46		4.20
Minnesota.				
Minneapolis	95	45	70.4	2.33
Snelling, Fort	96	39	72.4	3.13
Missouri.				
Carthage	100	53	79.7	3.82
Centreville	103	43		5.22
Central College*	105	50	79.5	3.06
Conception	100	50	78.1	1.57
Pierce City	100	52	77.3	3.10
Warrenton	101	60	77.8	
Montana.				
Assinaboine, Fort	97	46	70.2	0.17
Ellis, Fort	102	34	68.2	1.01
Keogh, Fort	112	36	76.0	0.32
Missoula, Fort	90	44	67.2	0.30
Shaw, Fort	95	35	69.1	0.28
Nebraska.				
Brownville	102	53	78.0	2.12
Crete	99	46	75.0	3.24
De Soto *	100	49	75.8	2.71
Fairbury	100			3.49
Fremont *	97	40	74.1	2.77
Genoa	97	43	75.4	3.20
Hay Springs *	98	40	68.9	2.32
Marquette	96			3.73
Niobrara, Fort	105	35	75.8	1 82
Robinson, Fort	103	38	74.3	0.90
Sidney, Fort	101	38	71.5	1.04
Tecumseh	104	50	83.1	1.01
Nevada.				
Carson City	98	39	72.1	0.00
Halleck, Fort	94	40	70.9	0.24
McDermit, Fort	96	49	73.4	2.06
New Hampshire.				
Antrim				2.15
Ashland				3.54
Belmont				2.87
Berlin Mills	90	34	62.5	3.57
Bristol				3.22
Hanover				2.25
Lake Village				3.50
Nashua	95	38	67.5	2.71
Wier's Bridge				3.54
Wolfborough				3.19
Woodstock				3.87
New Jersey.				
Beverly *	92	56	71.6	2.15
Clayton *	96	51	71.8	2.98
Dover *	94	42	67.1	3.38
Egg Harbor City	92	43	70.8	5.36
Moorestown	93	52	70.1	2.44
Phillipsburg				1.81
Readington*	96	60	74.1	
Roseland				1.79
South Orange	88	54	68.0	1.10
Upper Montclair	88	52	71.0	2.59

Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
New Jersey—Cont'd.	°	°	°	*Inches*
Vineland	90	58	73.0	4.52
New Mexico.				
Bayard, Fort	93	53	72.7	1.90
Gallinas Spring	89	61	.....	5.12
Selden, Fort	102	59	79.9	1.05
Union, Fort	86	41	67.0	8.04
Wingate, Fort	92	52	67.0	2.96
New York.				
Auburn	87	47	66.1	2.49
Columbus, Fort	89	57	71.8	1.00
Cooperstown *	85	48	63.7	2.56
David's Island	92	52	72.0	1.27
Factoryville*	91	48	66.7	1.47
Humphrey *	86	46	62.3	2.57
Ithaca	92	47	67.0	1.69
Madison Barracks	87	46	68.0	3.92
Mountainville	92	44	68.4	4.35
Niagara, Fort	90	48	68.8	1.57
North Volney *	93	54	67.9	.....
Palermo*	89	50	65.3	2.30
Palmyra*	92	52	69.5	.....
Penn Yan	.....	.....	.....	4.30
Plattsburg B'ks	92	50	67.6	3.97
Setauket	85	53	69.2	3.00
West Point	94	48	71.9	4.60
White Plains	83	61	69.6	2.32
North Carolina.				
Chapel Hill	96	55	75.9	9.91
Lenoir	88	56	.....	10.20
Lincolnton	90	61	73.4	5.35
Raleigh	93	65	78.0	6.90
Reidsville *	100	54	76.4	.....
Statesville*	91	60	78.2	5.97
Weldon *	95	63	75.7	5.02
Ohio.				
Cleveland	90	49	69.4	2.00
Clyde	92	58	73.9	1.60
College Hill*	103	57	75.9	5.12
Elyria	91	51	.....	2.25
Garrettsville	93	39	66.2	2.74
Jacksonborough*	96	52	72.5	4.60
Napoleon	92	48	71.3	3.61
North Lewisburg	94	51	73.0	4.55
Portsmouth	88	54	71.8	3.98
Ruggles*	90	48	66.0	2.70
Tiffin b *	93	49	69.4	1.83
Tiffin a *	93	53	70.4	1.90
West Milton	98	52	75.0	7.75
Wauseon	95	43	69.5	4.86
Westerville	88	45	70.0	2 51
Yellow Springs	87	48	69.6	4.67
Oregon.				
Albany*	95	53	68.5	trace.
Bandon*	71	40	54.4	0.19
Eola *	87	56	65.7	0.00
East Portland *	88	50	.....	0.00
Klamath, Fort	91	29	61.8	0.02
La Grande	97	53	.....	0.1
Mount Angel*	90	54	68.2	0.00
Pennsylvania.				
Blooming Grove *	96	50	67.6	5.20
Bethlehem *	93	55	72.5	2.15
Catawissa *	91	50	70.5	1.59
Dyberry	90	42	64.5	1.98
Drifton	91	45	63.8	1.82
Easton	.....	.....	.....	2.63
Franklin*	86	40	61.9	1.62
Germantown*	94	56	.....	1.86
Grampian Hills*	90	52	68.0	2.92
Mahanoy Plane	94	61	76.5	1.63
Phillipsburg *	89	45	63.0	3.09

Stations.	Temperature. Maximum.	Minimum.	Mean.	Rainfall.
Pennsylvania—Con.	°	°	°	*Inches*
Quakertown	86	47	.....	.....
Wellsborough *	93	48	67.0	2.79
West Chester	91	53	70.6	1.27
Wysox	88	47	67.7	1.43
Zionsville	94	64	73.7	0.54
South Carolina.				
Aiken	94	63	79.8	5.60
Kirkwood *	88	64	75.8	2.38
Pacolet	85	67	75.2	7.01
Spartanburg	81	69	70.4	7.69
Stateburg*	96	60	77.2	2.12
Tennessee.				
Ashwood	98	62	80.0	2.99
Austin	96	64	77.4	6.08
Milan	103	53	77.4	3.47
Texas.				
Austin *	103	73	86.5	6.01
Clark, Fort	107	60	88.2	1.76
Cleburne	98	64	86.0	2.09
Comfort	.....	.....	.....	3.44
Concho, Fort	106	65	84.7	3.74
Corsicana	.....	.....	.....	1.15
McIntosh, Fort	105	70	90.0	2.76
New Ulm	104	64	84.0	4.04
Ringgold, Fort	106	66	88.9	0.38
Silver Falls	103	56	.....	3.43
Vermont.				
Brattleborough	93	42	68.0	3.29
Burlington	89	48	.....	3.22
Charlotte*	91	52	68.0	3.00
Lunenburg	85	49	64.5	4.70
Newport	88	48	65.9	5.00
Post Mills*	93	46	64.0	2.20
Poultney	90	42	67.0	3.97
Strafford	88	48	68.1	3.20
Virginia.				
Accotink	93	58	73.5	2.28
Bird's Nest*	93	66	78.1	6.20
Bruington	.....	.....	.....	3.55
Dale Enterprise*	95	57	76.4	5.85
Marion	85	57	70.0	6.09
Monroe, Fort	92	62	75.9	6.33
Rappahannock St'n	98	51	75.7	1.44
Snowville	85	53	.....	4.70
Summit	95	48	72.7	.....
University of Va	83	66	72.0	1.74
Variety Mills	93	54	72.0	2.88
Wytheville	84	46	69.3	4.78
Washington Territory.				
Bainbridge Island *	87	46	66.0	0.35
Kenewick	107	46	.....	trace.
Tacoma *	82	52	65.8	0.44
Townsend, Fort	82	47	62.6	0.23
Walla Walla, Fort	102	52	76.5	0.16
West Virginia.				
Clarksburg	88	49	73.6	1.59
Helvetia*	88	45	67.0	3.77
Parkersburg	89	50	72.0	2.52
Wisconsin.				
Delavan	90	45	69.2	7.40
Embarras *	92	46	69.0	7.00
Fond du Lac *	94	35	69.4	3.77
Madison	94	47	73.1	5.05
Manitowoc	92	45	66.4	1.37
Prairie du Chien	96	47	73.4	2.82
Wausau	90	39	66.2	4.47
Wyoming.				
Laramie, Fort	100	42	72.4	1.06
McKinney, Fort	101	43	71.6	0.40
Washakie, Fort	99	40	72.0	0.00

NOTES AND EXTRACTS.

The following is an extract from the August, 1886, report of the "Alabama Weather Service," under direction of Prof. P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn:

During the month of August the temperature has been slightly (1°.5) below the normal. The average temperature of the month is the same as that given in the July bulletin. The middle of August was quite warm for several days, and then the temperature began to fall, making the close of the month cool and pleasant.

The precipitation was also but little below the normal (0.40 of an inch) and the rains were favorably distributed throughout the month. The northern part of the state was less fortunate in the quantity of rain that fell than middle and southern Alabama. The last two sections received fully 1.72 inches more rain than the first.

During most of the month the crops were in excellent condition, every indication pointing to a handsome yield from the cotton fields. The last week, however, the cotton plant suffered in some degree, and there has been a slight falling off from the earlier indications. Nevertheless, the reports from all sections of the state pronounce the crop an excellent average yield for August.

State summary.

Temperature.—Mean temperature, 79°; highest temperature, 103°, at Birmingham, on the 18th; lowest temperature, 41°.8, at Chattanooga, on the 7th; range of temperature, 61°.2: greatest monthly range of temperature, 46°, at Gadsden; least monthly range of temperature, 21°, at Selma University; mean daily range, 13°.3; greatest daily range of temperature, 35°, at Gadsden, on the 11th; least daily range of temperature, 0°, at Valley Head, on the 24th.

Rainfall.—Mean depth of rainfall, 3.84 inches; mean daily rainfall, 0.154 inches; greatest depth of monthly rainfall, 1.32 inches, at Newton; least depth of monthly rainfall, 1.23 inches, at Bermuda; greatest daily rainfall average for state, 0.65 inches, on the 2d; greatest daily local rainfall, 4.00 inches, at Newton, on the 30th.

Average number of days on which rain fell, 9.7; average number of cloudy days, 9; average number of fair days, 14; average number of clear days, 8.

Warmest day, 16th; coldest day, 31st.

Prevailing direction of wind, southeast.

The following meteorological summary, for August, 1886, is from the Georgia "Crop Report," prepared by Hon. J. T. Henderson, Commissioner of Agriculture for Georgia:

Districts.	Temperature. Mean maximum.	Mean minimum.	Mean.	Average precipitation.
	°	°	°	*Inches.*
Northern Georgia	92.0	63.0	69.7	3.68
Middle Georgia	95.0	64.0	79.9	3.80
Southwestern Georgia	95.0	69.0	80.7	5.60
Eastern Georgia	94.0	66.0	79.5	3.50
Southeastern Georgia	93.0	70.0	81.6	5.34
Means for state	94.0	66.0	78.3	4.38

The following meteorological summary and accompanying remarks are from the August, 1886, report of the "Indiana Weather Service," under direction of Prof. H. A. Huston, of Purdue University, Lafayette:

Districts.	Temperature. Highest.	Lowest.	Monthly means.	Average precipitation.
	°	°	°	*Inches.*
Northern counties	98.0	47.0	72.0	5.31
Central counties	97.0	44.0	72.1	6.12
Southern counties	102.0	51.0	74.6	4.58
State	102.0	44.0	72.9	5.34

The mean temperature of the state for August, 1886, was 1°.7 above the mean of August for the past four years; 0°.5 below the mean of sixteen years at Indianapolis; 0°.2 above the mean of thirty-one years at Logansport; 3°.0 below the mean of twenty-one years at Vevay; 1°.4 above the mean of thirty-two years at Spiceland; 3°.2 above the mean of seven years at Mauzy; 2°.1 below the mean of nine years at Blue Lick; 1°.8 above the mean of five years at Worthington; 2°.4 above the mean of five years at Connersville; 0°.2 above the mean of seven years at Lafayette; and about 2°.0 below the normal temperature of the month. The mean temperatures at various stations range from 3°.2 above the average (Worthington) to 1° below the average (Vevay).

The precipitation at all stations was above the average, the excess ranging from 0.04 inches at Vevay to 4.29 inches at Mauzy.

The following meteorological summary and accompanying remarks are from the August, 1886, report of the "Indiana Weather Service," under direction of Prof. W. H. Ragan, of De Pauw University, Greencastle:

Districts.	Temperature. Highest.	Lowest.	Monthly means.	Average precipitation.	Summer. Mean temperature.	Precipitation.
	°	°	°	*Inches.*	°	*Inches.*
Northern counties	98.0	42.0	72.1	5.54	71.5	12.04
Central counties	97.0	44.0	71.9	6.70	71.8	14.78
Southern counties	102.0	50.0	74.8	4.89	73.8	14.26
State	102.0	42.0	72.9	5.71	72.4	13.69

The temperature generally averaged a little below normal for both month and season. The precipitation was above normal for both month and season, generally. Connersville reports tornado on the 22d, north of town; destroyed trees through a forest; track about two hundred feet wide; broke trees off mostly ten to twenty feet above ground; no lightning; heavy rain after.

The following is from an advance sheet of the "Iowa Weather Bulletin," for August, 1886, prepared under direction of Gustavus Hinrichs, M. D., Iowa City:

August, 1886, was hot, fair, and generally dry, with a few intense storms; southerly winds and calms prevailing.

The mean temperature of the air was over four degrees above normal, being the hottest on record for over twenty-five years, excepting August 1881, which was one degree warmer. The first decade was normal; the second and third were six degrees above normal. The number of hot days on which the temperature reached or exceeded 86° was twenty-one, which is the highest ever recorded, being three in excess of August, 1881.

The temperature remained high until the last two days of the month, when the night temperatures ran down low into the forties. On account of the clear sky a light hoar frost covered most of northern Iowa early on the 30th. A more severe hoar frost reached down to Rock Island on the morning of the 31st.

Rainfall was nearly normal in frequency, but very unevenly distributed in amount. The greater part of the state, forming a broad belt about two hundred miles wide, and running from southwest to northeast, received less than two inches of rain. In the northern-middle part of this territory less than one inch fell. Thus the northeast and southwest were dry, as well as the centre of the state.

The following is an extract from the August, 1886, report of the "Missouri Weather Service," under direction of Prof. Francis E. Nipher, Washington University, Saint Louis:

Temperature.—The mean temperature for the past month was 3°.3 above the normal for August at the central station. The lowest temperature observed during the month was 57°.3, on the 31st, the only day during the month that the temperature fell below 65°, and on eight days it did not fall below 75°. The highest temperature occurred on the 16th, when the thermometer registered 103°. This is, excepting August 9th and 11th, 1881, when it was 104° and 105°, respectively, the highest temperature observed at Saint Louis during August since 1837. The temperature rose above 90° on twelve days during the month.

Precipitation.—The rainfall at the central station was 2.60 inches, which is 1.44 inches below the normal for August.

In the state the highest temperatures reported range from 100° at Ironton to 109° at Pro Tem. The lowest temperatures range from 44° at Ironton to 62° at Pleasant Hill, and were observed on the 31st all over the state.

The rainfall was over five inches in the northeast part of the state, while in the northwest and central parts only a little over one inch fell, and towards the southwest it was over three inches.

The following is from the August, 1886, report of the "Nebraska Weather Service," under direction of Prof. Goodwin D. Swezey, of Doane College, Crete:

The weather for August has presented no striking peculiarities, unless it be the occurrence of a decidedly cool wave at the very close of the month; the mean temperature has been slightly above the average for August, and the highest temperatures of the month have also been above those of August commonly, having been exceeded only once in eight years, viz., in 1881. But on the morning of the 29th a cool wave appeared in the Northwest, and moved in a southeasterly direction, causing a decided fall in temperature in all directions on the 30th and 31st. During its passage frosts were reported in Dakota, Minnesota, Wisconsin, and Nebraska, and killing frost in southern Dakota. The frost was very slight in Nebraska.

The precipitation has not shown the great deficiency that has prevailed for the past few months, being but slightly below the normal for the month over the state generally, while in certain districts in the central part of the state it has been large, the greatest rainfall being 9.5 inches at Minden.

The following is an extract from the August, 1886, "Bulletin of the New England Meteorological Society," under direction of Prof. Winslow Upton, Providence, Rhode Island:

Reports for the month were received from one hundred and fifty observers.

General Conditions.—The month was characterized by an abundance of fair weather, with a moderate supply of rain and a small number of thunder-storms. The temperature was below the average and there was an absence of destructive winds. The meteorological history of the month, which presents features varying in no essential respect from those usually found in August, can best be given by describing the course of the barometric pressure. A well-developed depression, passing far north of New England on the 1st and 2d, was attended by general rains and a few thunder squalls. The pressure rose to the normal and remained nearly stationary until the 9th and 10th, when it rose above the average. This period was pleasant, with the exception of slight showers on the 5th and 7th. Two depressions passed north of the district on the 11th and 13th, the second being well marked. Thunder showers, with copious rains, occurred in connection with their passage. On the 16th a cyclonic depression, with pressure at the centre 29.6 inches, moved easterly directly across southern New Hampshire and Vermont, attended by heavy general rains. After its passage the pressure rose rapidly and remained above the average until the 22d, when it fell under the influence of a severe cyclone from the West Indies, which had been felt in the Gulf of Mexico on the 20th and probably advanced northeasterly in the Atlantic Ocean; it was too far from the shore, however, to materially affect the weather conditions in New England. The pressure was not far from the normal until the 30th, when a depression approached from the Lakes and on the 31st moved down the Saint Lawrence Valley; rains, with some thunder and lightning, were experienced. It will be noted that the barometric depressions enumerated above moved in the usual path, easterly from the Lakes, all passing north of the boundary of New England, except one which moved directly over the district. The cyclones which at this season of the year may be expected from the South are represented by the severe cyclone which was nearest to the coast on the 22d, but whose path lay in the ocean.

The following is from the August, 1886, report of the "Ohio Meteorological Bureau," under direction of Prof. B. F. Thomas, of the Ohio State University, Columbus:

The mean temperature was 70°.9, which is 0°.6 above the four-year mean, but 1°.3 below the normal for the state, as given in our first annual report. The highest temperature recorded was 95°, on the 11th. The lowest was 48°, on the 3d and 4th. These extremes are both within the records for the preceding three years, giving a total temperature range of 52°, which is 6° lower than in 1885, and 7° lower than the average for 1883, 1884, and 1885. The mean daily range of temperature was likewise low, being 20°.6, while the four-year mean was 21°.8.

The number of cloudy and rainy days was greater than usual. The mean rainfall, 3.62 inches, is .3 inch above the four-year average, but .14 inch below the normal. The greatest rainfall was reported from Greenville, 8.72 inches, and the least, 1.36 inches, from Cleveland.

General rains occurred on the 1st, 11th, 13th, 14th, 16th, 22d, 23d, and 30th. Local rains occurred on the 5th, 10th, 12th, 15th, 17th, 28th, and 29th. The rains of the 5th, 10th, and 28th were confined almost entirely to the northern section of the state, and those of the 12th, 15th, and 17th were reported only from the middle and southern sections. The greatest mean rainfall for the month was recorded in the middle section, and the least in the northern.

The following is an extract from the "Tennessee State Board of Health Bulletin," for August, 1886, prepared under the direction of J. D. Plunkett, M. D., President of the State Board of Health. The weather report is prepared by Major H. C. Bate, in charge of the State Meteorological Service:

The special features for August were the high temperatures on the 16th and 17th; the abnormal rainfall in some portions of the state, and the earthquake of the night of the 31st. The other meteorological conditions showed very little, if any, departures from the normal.

The mean temperature was 75°.6, which was about the same as that of the corresponding period of last year, and respectively two and three degrees above that for the same month in 1884 and 1883. The highest temperature was 103°, recorded on the 17th, and was one degree above the maximum recorded last year, which was the highest point reached since the establishment of the State Weather Service; the next highest recorded during the month was 101°, on the same date. The lowest temperature was 52°, and was recorded on the 31st. This was two degrees above the minimum of August, of last year; four degrees above that of August, 1884, and nine degrees above that of August, 1883. During the first decade of the month there was a period of low temperature ending with the 9th.

The mean precipitation was 4.05 inches, 1.75 inches above the mean of August of last year, and nearly 2 inches above that of August, 1884. Of this amount the eastern division received an average of nearly 4¼ inches, the middle division received nearly 3¾ inches, and the western division about 4 inches. The greatest rainfall was 8.28 inches, reported at Riddleton, and was the greatest for the month of August of any of the preceding years recorded by the State Weather Service; the next greatest being in 1883, when 6.38 inches were recorded. The smallest monthly rainfall was 1.33 inches, reported at Sailor's Rest, on the lower Cumberland, which station reported next to the smallest amount in July. The greatest local daily rainfall was 2.60 inches, reported on the 1st at Covington. A daily rainfall of 2.18 inches was reported at Memphis on the same day. On the 30th Riddleton reported a fall of 2.55 inches, and Hohenwald a fall of 2.18 inches.

State summary.

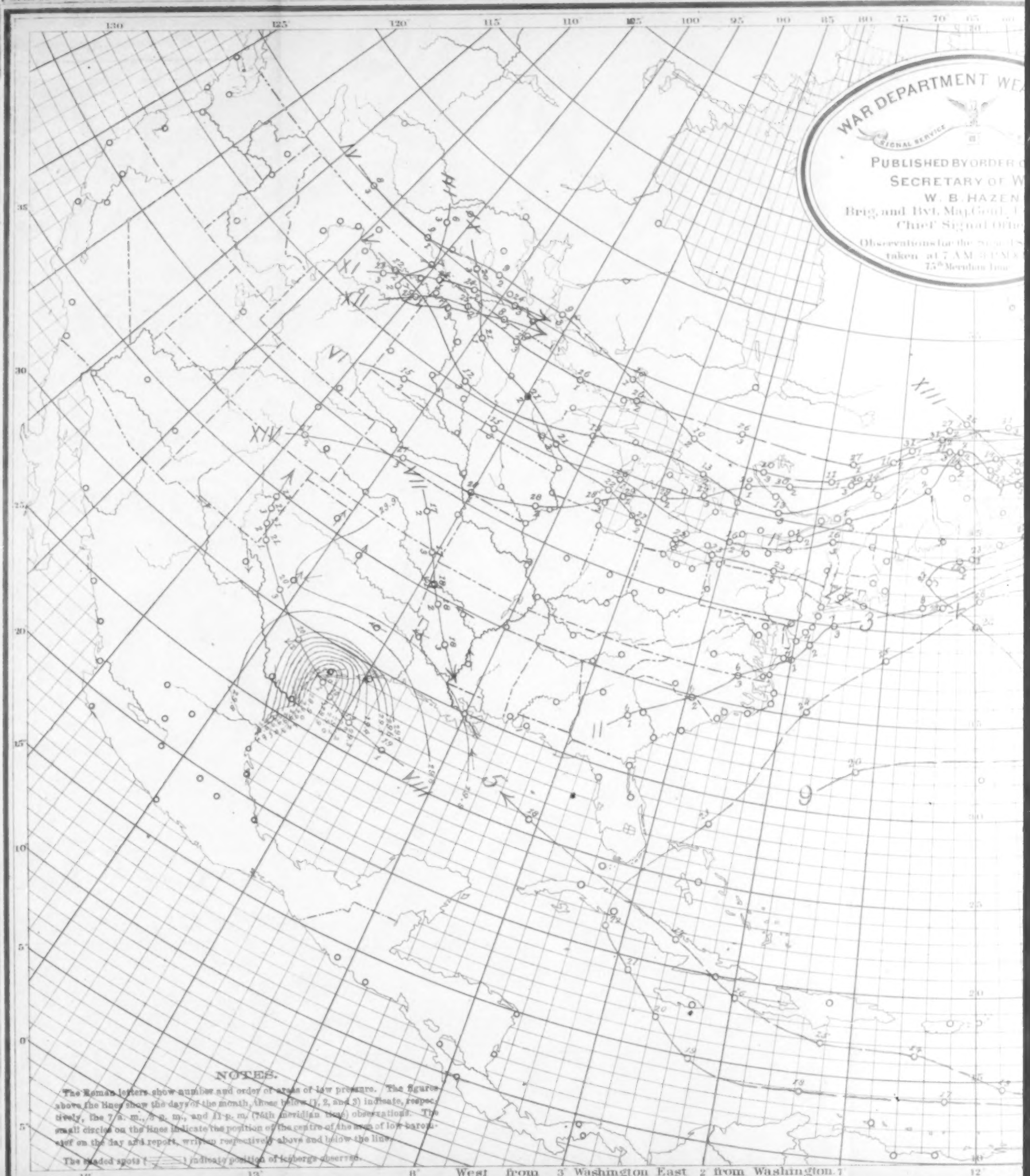
Mean temperature, 75°.6; highest temperature, 103°, on the 17th, at Milan; lowest temperature, 52°, on the 31st, at Fostoria and Trenton; range of temperature, 51°; mean monthly range of temperature, 35°.9; greatest monthly range of temperature, 50°, at Milan; least monthly range of temperature, 26°, at Greeneville; mean daily range of temperature, 11°.8; greatest daily range of temperature, 34°, on the 9th, at Hohenwald; least daily range of temperature, 2°, on the 1st at Howell, on the 5th at Greeneville and Careyville, on the 25th at Hurricane Switch, and on the 30th at Riddleton; mean of maximum temperatures, 80°.9; mean of minimum temperatures, 59°.3.

Mean depth of rainfall, 4.05 inches; mean daily rainfall, 0.131 inch; greatest rainfall, 8.28 inches, at Riddleton; least rainfall, 1.33 inches, at Sailor's Rest; greatest local daily rainfall, 2.60 inches, on the 1st at Covington; days of greatest rainfall, 1st, 2d, 6th, 23d, 24th, 29th, 30th; day of greatest rainfall, 1st. Average number of days on which rain fell, 10; average number of clear days, 10.3; average number of fair days, 13.9; average number of cloudy days, 6.8. Days without rainfall, 3d, 8th, 9th, 10th; warmest days, 16th, 17th; coldest day, 31st.

Prevailing wind, west.

Form 106 G 1884.

Chart I. Tracks of Areas of Low P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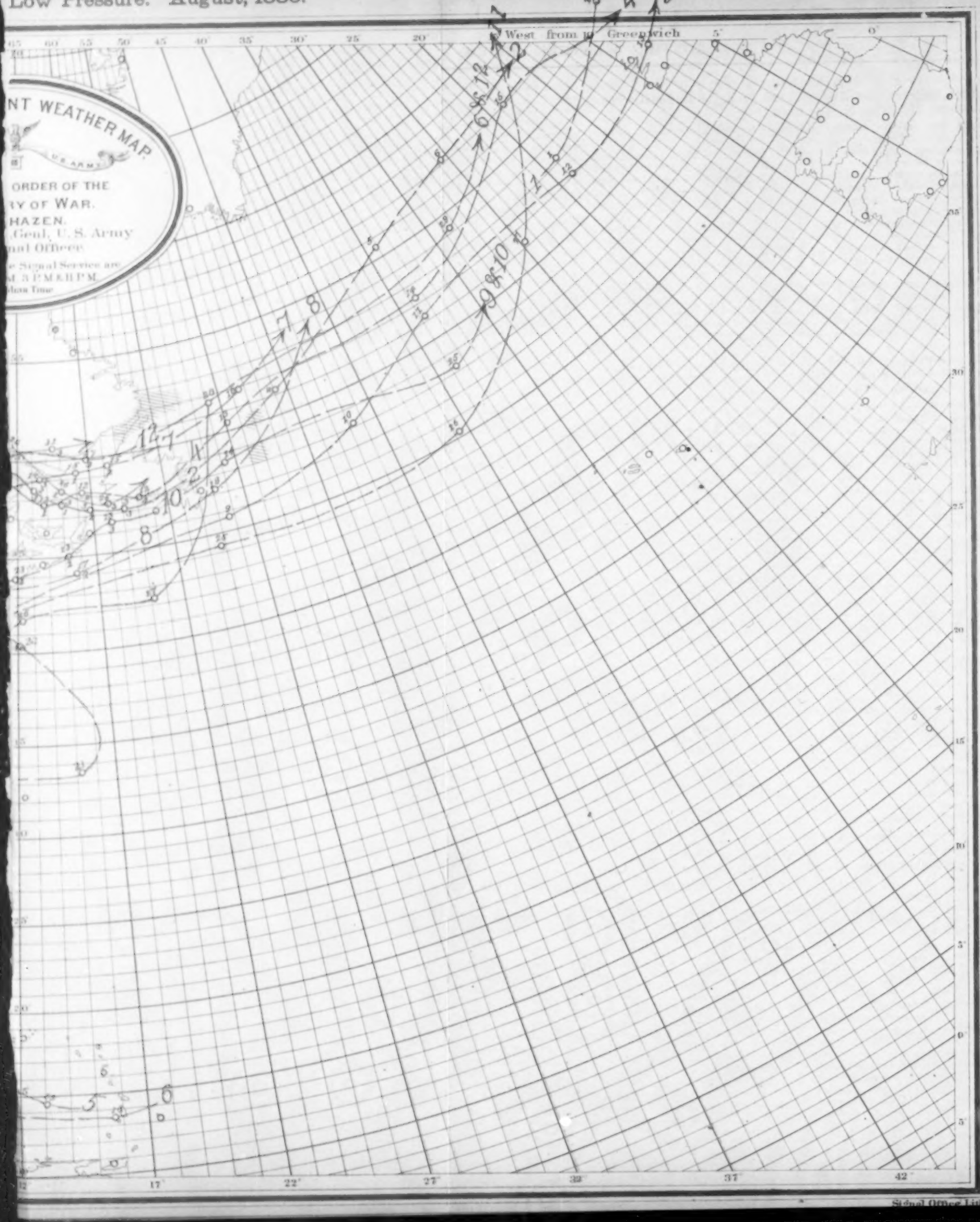
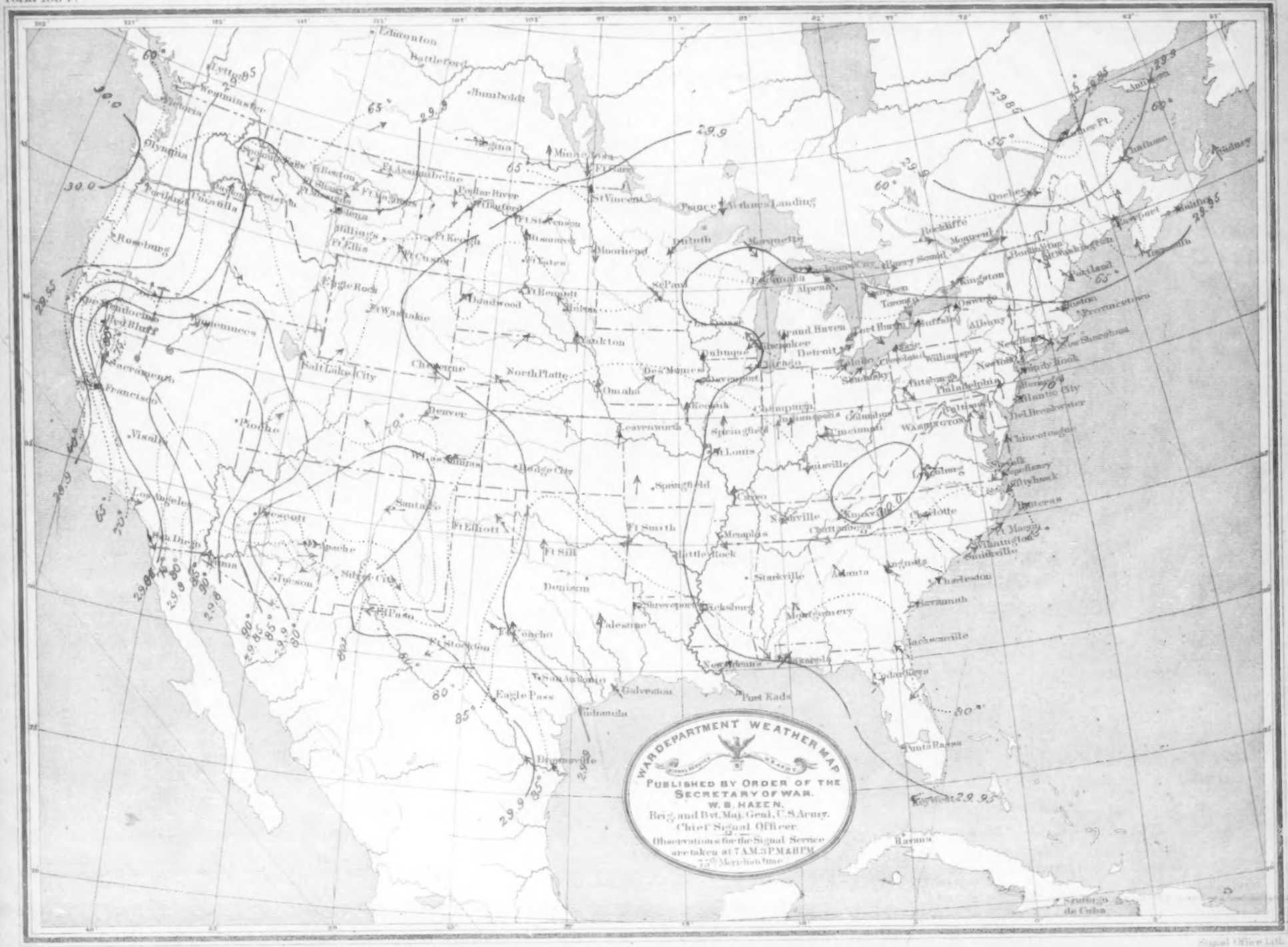
Low Pressure. August, 1886.



Signal Office Lith.

Form 106 F.

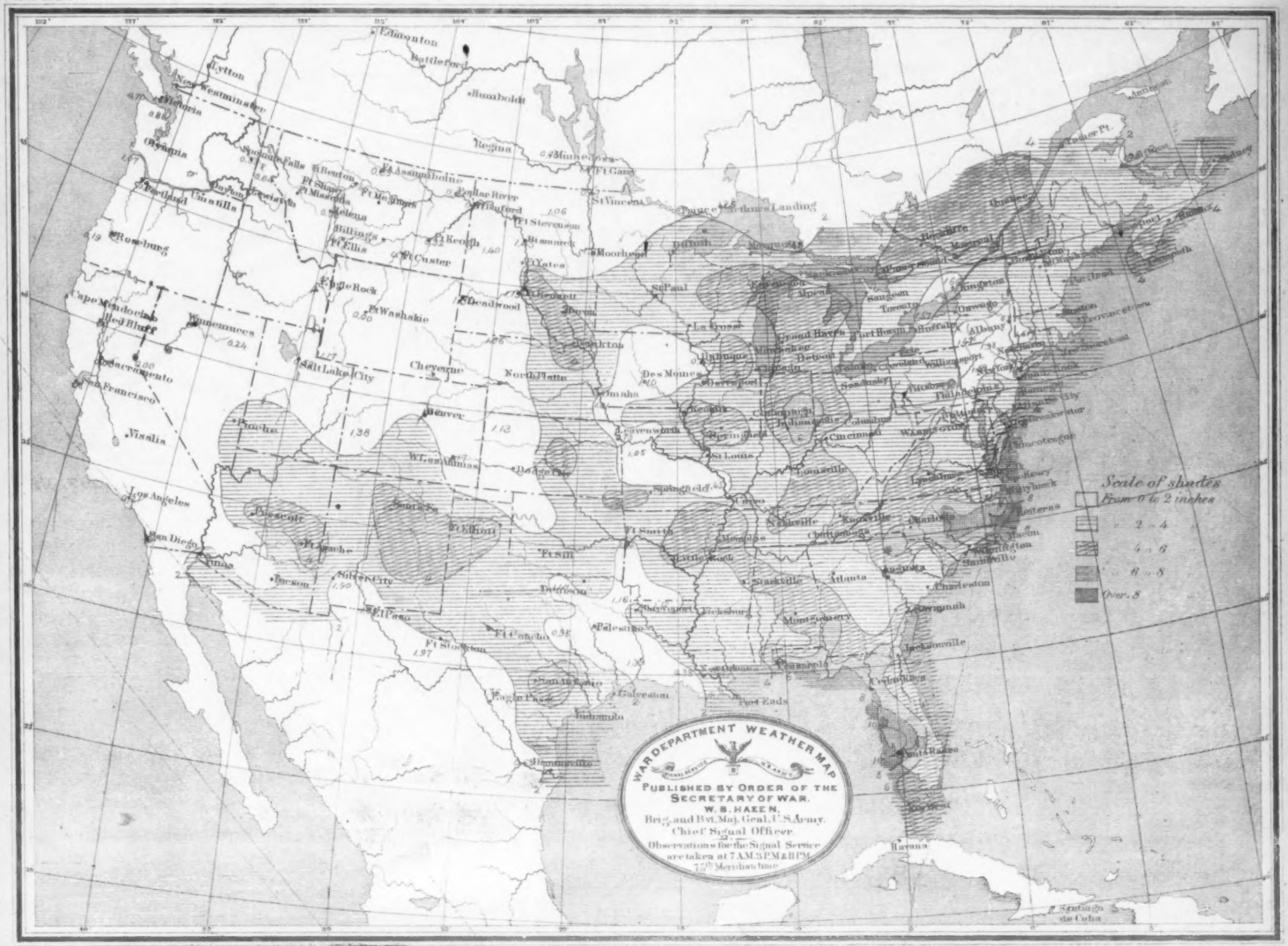
Chart II. Isobars, Isotherms, and Winds. August, 1886.


WAR DEPARTMENT WEATHER MAP
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
W. B. HAZEN.
Brig. and Bvt. Maj. Genl. U.S. Army.
Chief Signal Officer.
Observations for the Signal Service are taken at 7 A.M. 3 P.M. & 11 P.M. 75° Meridian time.

Signal Office Lith.

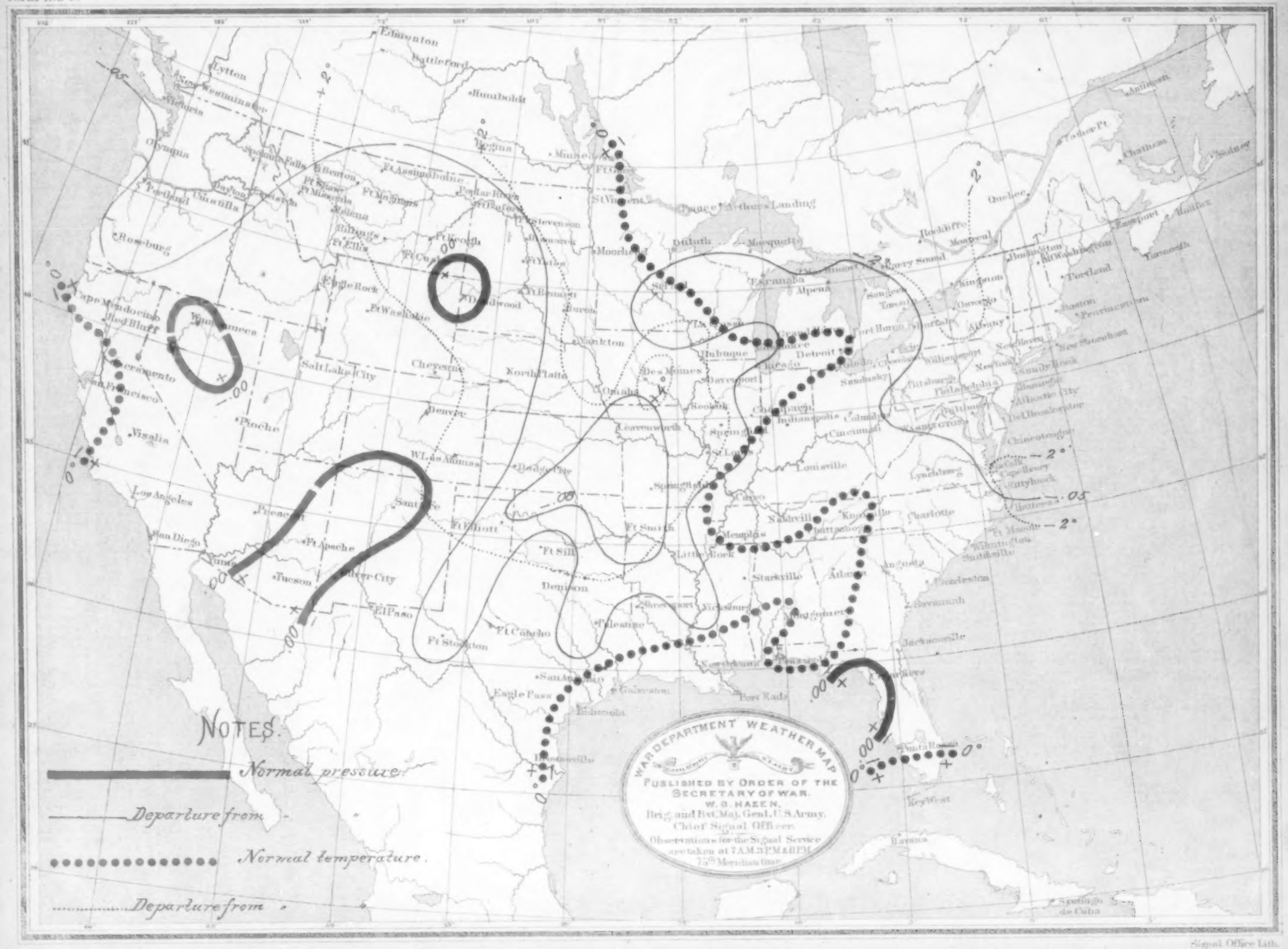
Form 106 F.

Chart III. Precipitation, August, 1886.


Scale of shades
From 0 to 2 inches
2 - 4
4 - 6
6 - 8
Over 8
WAR DEPARTMENT WEATHER MAP
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
W. B. HAZEN,
Brig. and Bvt. Maj. Genl. U.S. Army.
Chief Signal Officer.
Observations for the Signal Service are taken at 7 A.M. 3 P.M. & 11 P.M. 75th Meridian time.

Form 106 F.

Chart IV. Departures from Normal Atmospheric Pressure and Temperature. August, 1886.


NOTES.
Normal pressure.
Departure from
Normal temperature.
Departure from
WAR DEPARTMENT WEATHER MAP
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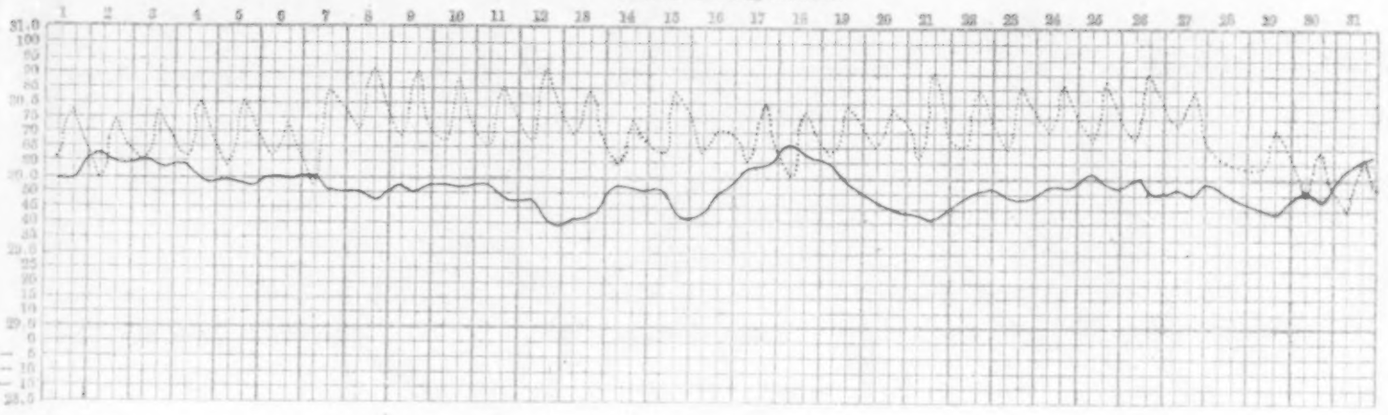
W. B. HAZEN,
Brig. and Bvt. Maj. Genl. U.S. Army,
Chief Signal Officer.
Observations for the Signal Service are taken at 7 A.M. 3 P.M. & 11 P.M. 75th Meridian time.

Signal Office Lith.

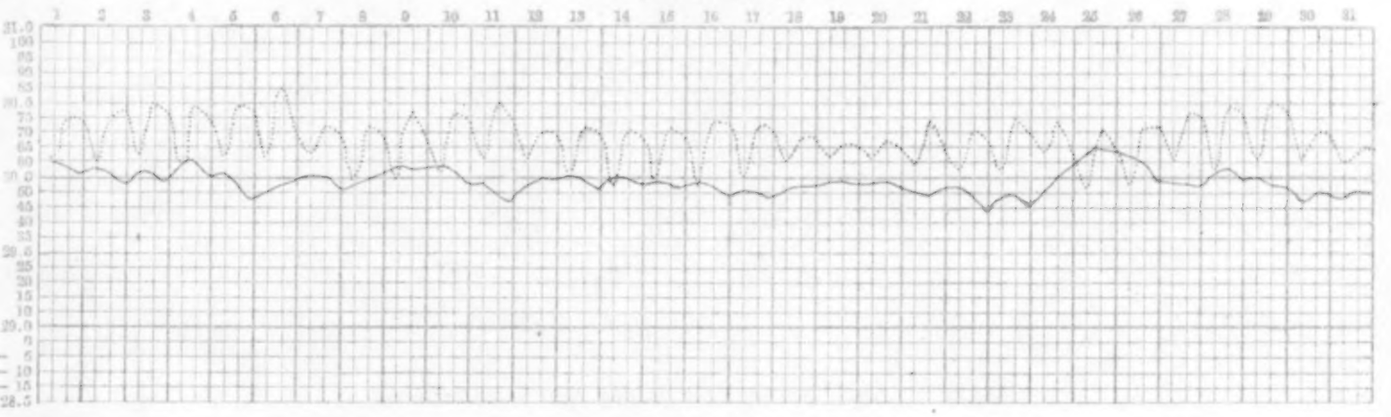
Chart V. Pressure (————) and Temperature (·····) Curves. August, 1886.

EASTPORT, ME.

SAINT PAUL, MINN.

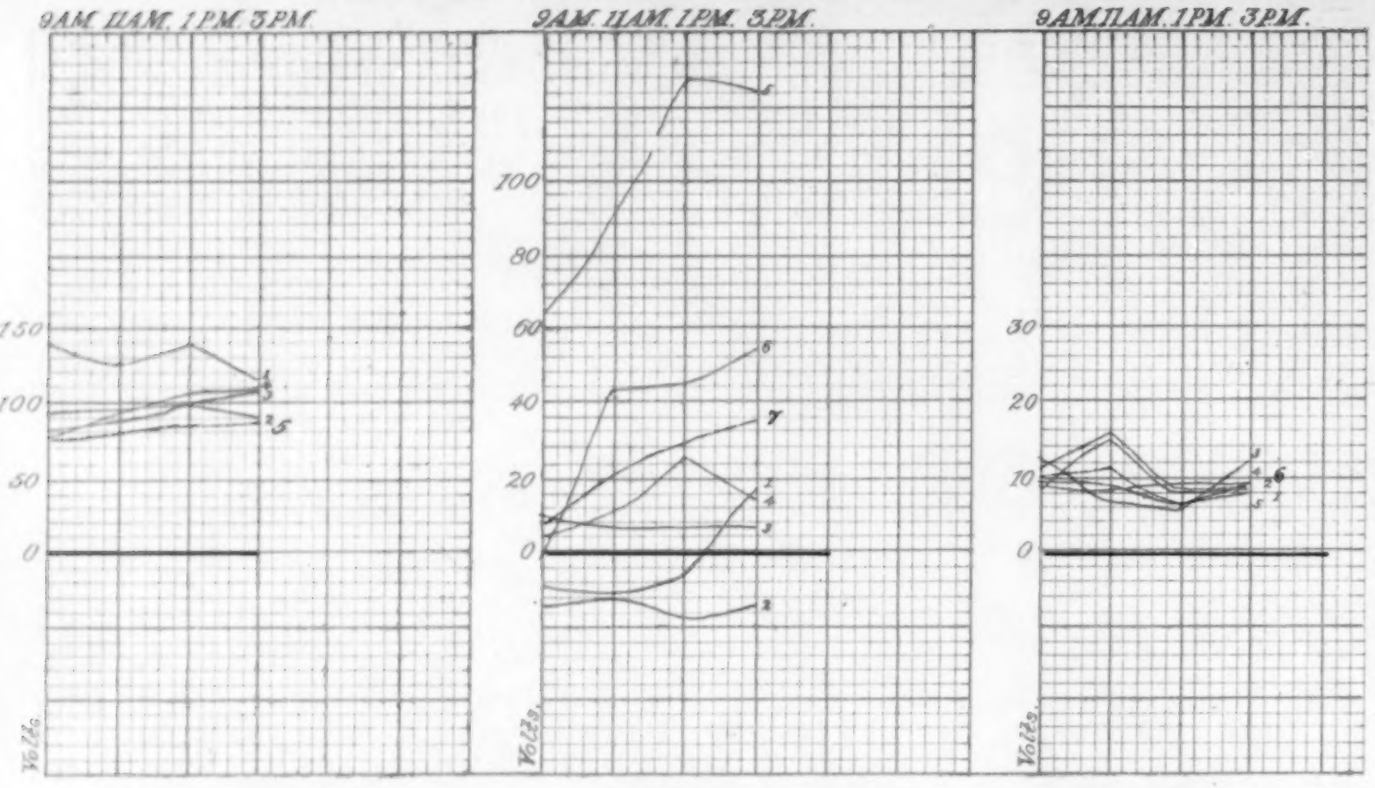


PORTLAND, OREG.



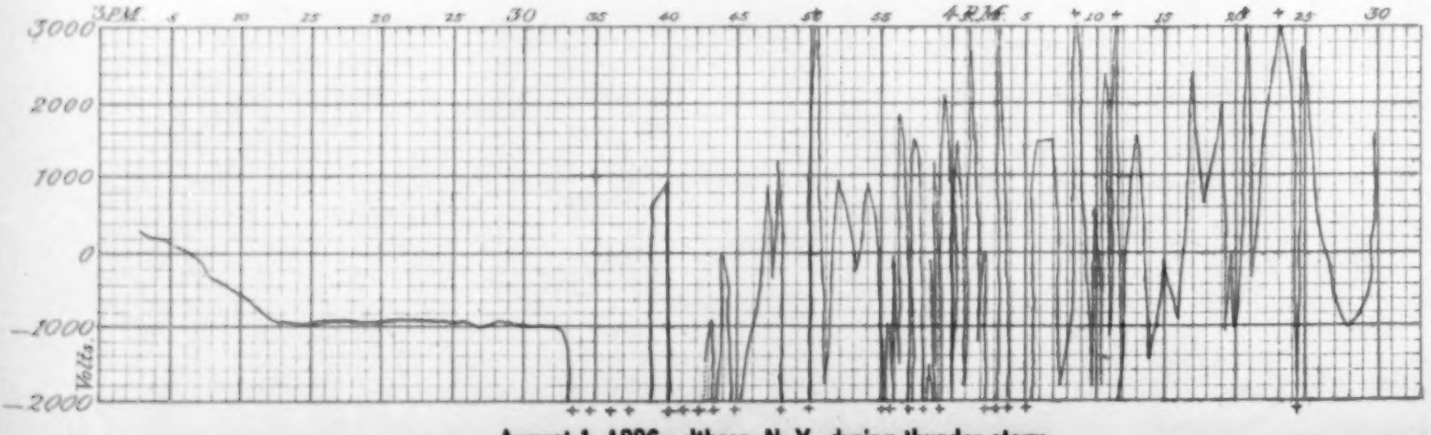
NEW ORLEANS, LA.

Chart VI. Curves showing Electrometer Readings.



Washington, D. C., July, 1886. Boston, Mass., July, 1886. New Haven, Conn., July, 1886.

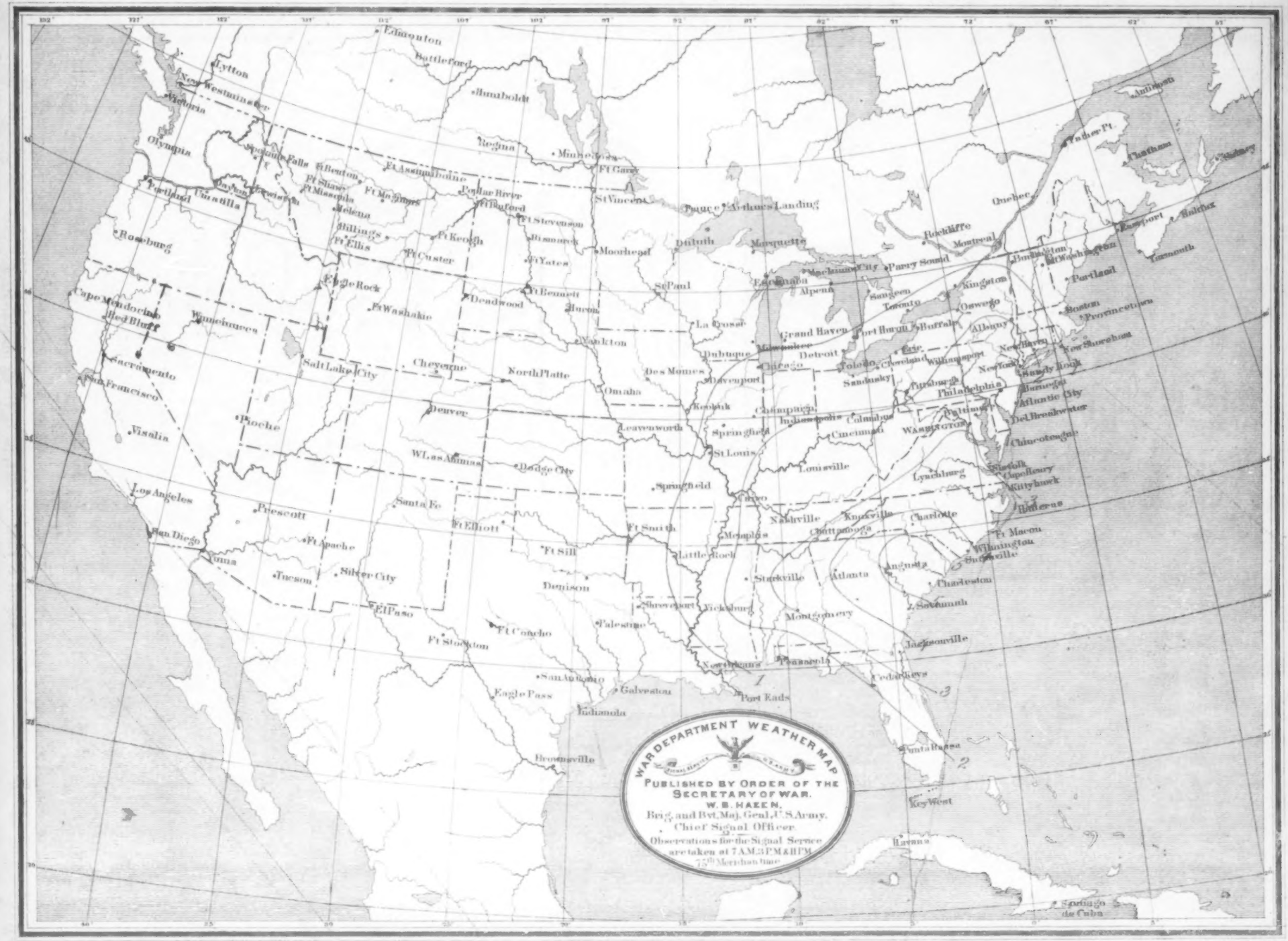
August 3, 1886. Boston, Mass., during light thunder-storm.



August 1, 1886. Ithaca, N. Y., during thunder-storm.

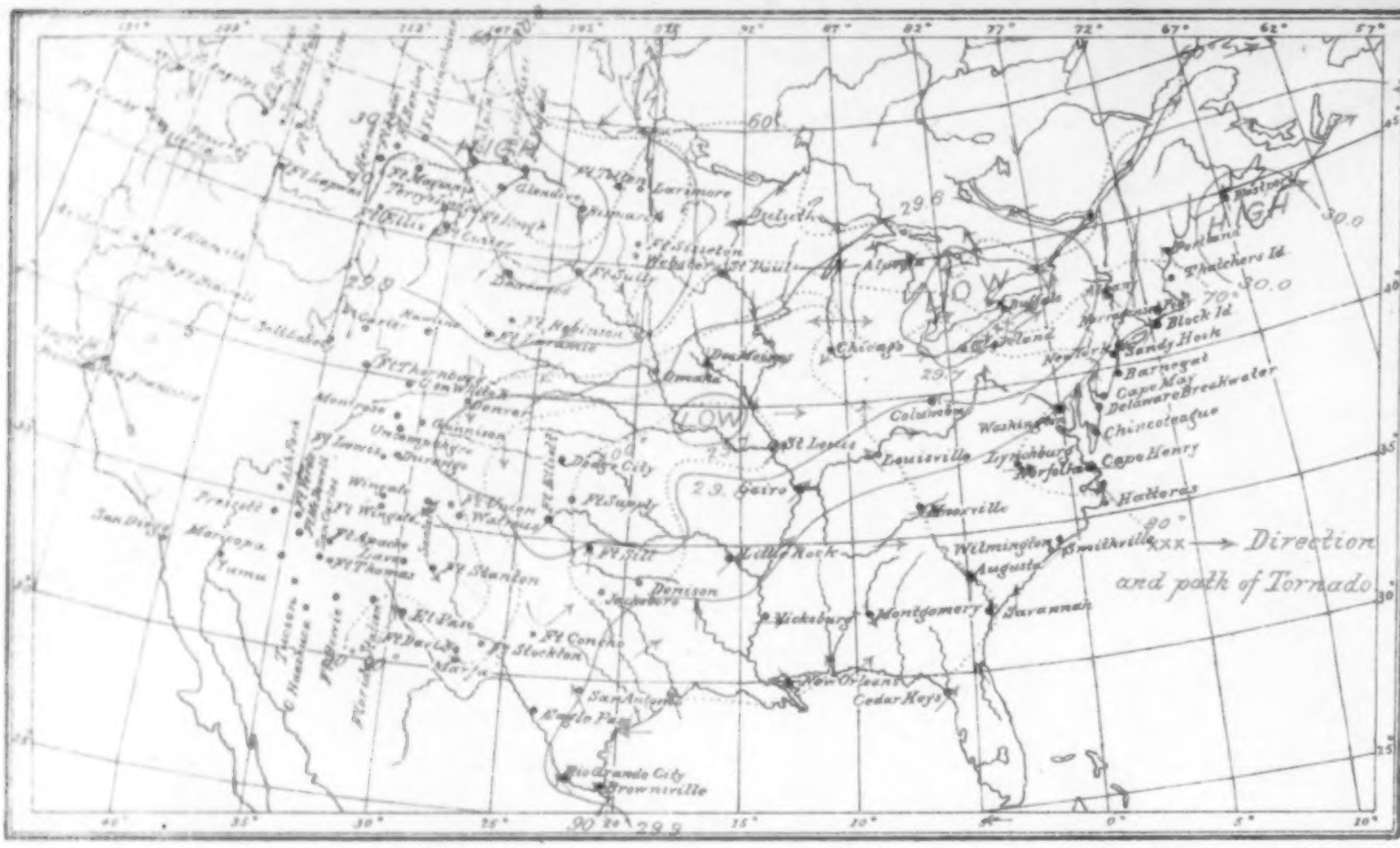
Form 106 F.

Chart VII. Showing area affected by earthquake of August 31, 1886, with lines of equal intensity.



Signal Office Lith.

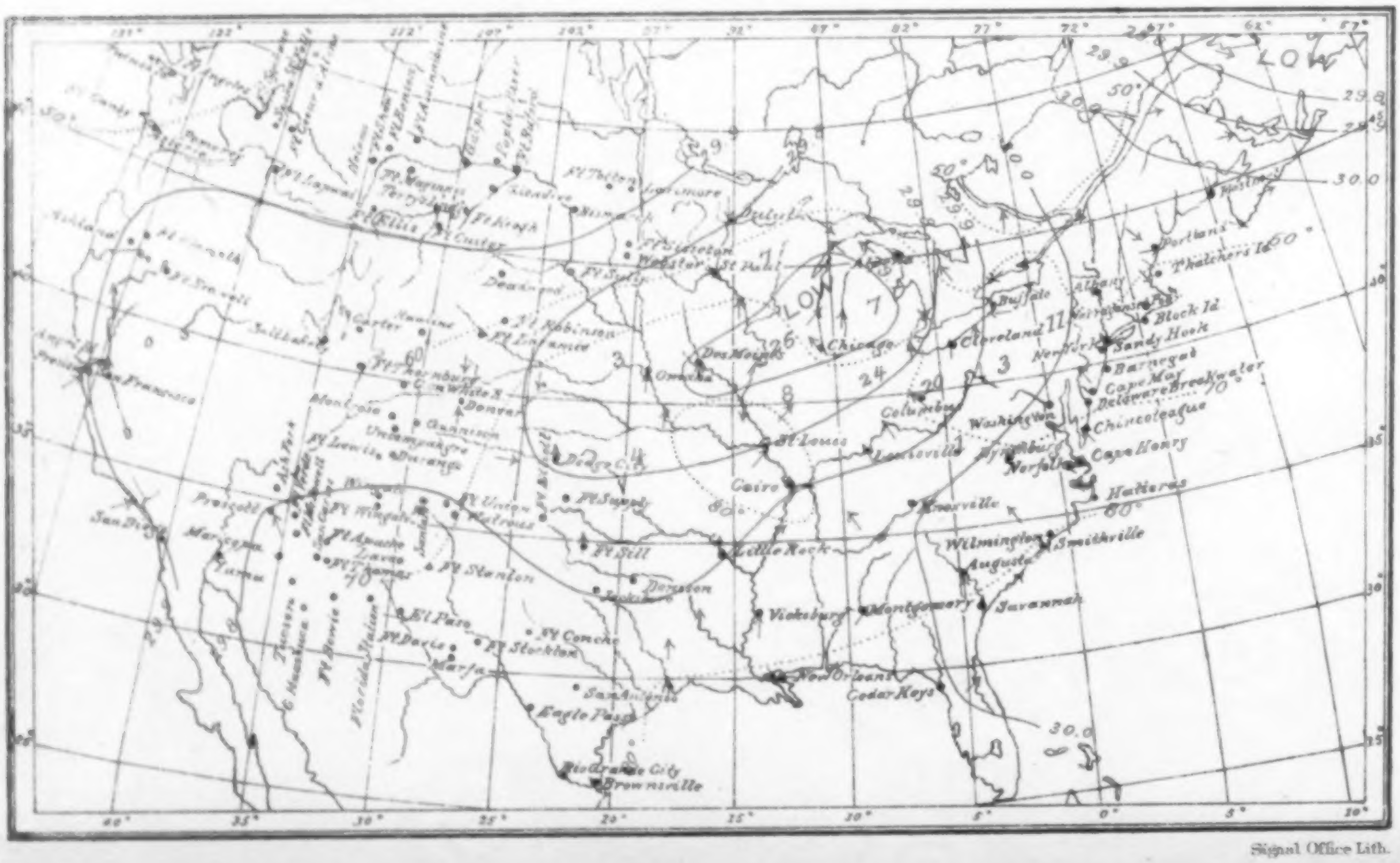
Chart VIII. Isobars, Isotherms, and Wind Directions. 3 p. m. (Eastern time), August 16, 1886.



Signal Office Lith.

Chart IX. Isobars, Isotherms, and Wind Directions. 7 a. m. (Eastern time), August 16, 1886.

Figures in each state indicate the number of thunder-storms in the state on this date.



Signal Office Lith.

Voluntary observers of the Signal Service, on land, from whom meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for August, 1886.

Observer and place of observation.
Andrews, Luman, Southington, Conn.
Anderson, Dr. W. W., Stateburg, S. C.
Altaffer, J. M., Independence, Kans.
Adams, Dr. O. H., Vineland, N. J.
Abbott, Dr. E. K., Salinas, Cal.
Arents, Hiram, Oroville, Cal.
Adams, A. H., Fort Meade, Fla.
Avey, O. H., Oscaloosa, Iowa.
Beans, Thos. J. Moorestown, N. J.
Bushnell, W. S., Monticello, Ind.
Bentley, David, Princeton, Cal.
Boerner, Prof. Chas. G., Vevay, Ind.
Boynton, John F., Syracuse, N. Y.
Bayerly, J. F., Spartanburg, S. C.
Ballou, Dr. N. E., Sandwick, Ill.
Bennett, Geo., Bandon, Oreg.
Bell, Joseph, Franklin, Pa.
Blake, J. H., Blue Lake, Cal.
Baker, Dr. Henry B., Lansing, Mich.
Beall, Dr. R. L., Lenoir, N. C.
Brendel, Dr. Fred., Peoria, Ill.
Bartlett, E. B., Vermillion, N. Y.
Baldwin, A. L., Bethel, Conn.
Briggs, John, Albany, Oreg.
Betts, Prof. Arthur, Webster, Dak.
Breed, J. E., Embarras, Wis.
Boyd, Joseph, Oskaloosa, Iowa.
Boies, Lieut. A. H., Hudson, Mich.
Broberg, Mrs. Mary W., Manatee, Fla.
Black, W. H., Kalamazoo, Mich.
Blachly, C. P., Manhattan, Kans.
Bridges, Q. A., Berlin Mills, N. H.
Beecher, Chas., Wysox, Pa.
Bowman, Peter, Ruggles, Ohio.
Cook, S. A., Milledgeville, Ga.
Carrington, G. D., Brownville, Nebr.
Clark, T. A., Wausau, Wis.
Charbonnier, Prof. L. H., Athens, Ga.
Casey, Geo., Auburn, N. Y.
Crawford, E. A., Liberty Hill, La.
Curtiss, G. G., Fallston, Md.
Cornell University, Ithaca, N. Y.
Cutting, Dr. Hiram A., Lunenburg, Vt.
Crosier, Adam, Laconia, Ind.
Caulkins, John S., Thornville, Mich.
Cass, John J., Allison, Kans.
Cleveland, Dr. G. H., Pentwater, Mich.
Collie, G. L., Delevan, Wis.
Cotton, Dr. D. B., Portsmouth, Ohio.
Cheney, Wm., Minneapolis, Minn.
Carpenter, W. B., Leavenworth, Kans.
Carter, Rev. Dr. W. H., Tallahassee, Fla.
Cummings, L. D., Palmyra, N. Y.
Chubb, Thos. H., Post Mills, Vt.
Cole, Seward, Cahuenga, Cal.
Cutler, B. B., Heath, Mass.
Clark, T. A., Weldon, N. C.
Colton, Prof. G. H., Hiram, Ohio.
Caffee, Wm. K., Carthage, Mo.
Chandler, Dr. W. J., South Orange, N. J.
Cass, W. Earle, Roseland, N. J.
Calhoun, P. B., Austin, Tenn.
Chapin, Adams, Poway, Cal.
Childs, W. H., Brattleborough, Vt.
Crump, M. H., Bowling Green, Ky.
Cowgill, Prof. E. B., Manhattan, Kans.
College of the Sacred Heart, Prairie du Chien, Wisconsin.
Davis, W. O., Bloomington, Ill.
Dechant, W. H., Mahony Plane, Pa.
Dunlap, W. L., Tecumseh, Nebr.
Dudley, C. B., Altoona, Pa.
Dazey, J. B., Charleston, Ill.
Deming, H. D., Wellsborough, Pa.
Dozier, Wm., Mattoon, Ill.

Observer and place of observation.
Dewhurst, Rev. E., Voluntown, Conn.
Day, Theodore, Dyberry, Pa.
Dawson, Wm., Spiceland, Ind.
Ellsworth, W. W., Hartford, Conn.
Ellason, W. A., Statesville, N. C.
Ellis, John, Marquette, Nebr.
Ewell, Dr. M. D., South Evanston, Ill.
Eckstein, Rev. M., Conception, Mo.
Fouch, Dr. A., Anderson, Cal.
Fitch, Dr. H. L., Urbana, Iowa.
Fox, G. W., Murietta, Cal.
Ferris, B. F., Sunman, Ind.
Friend, Chas. W., Carson City, Nev.
Fleming, J., Readington, N. J.
Fernald, Prof. M. C., Orono, Me.
Frick, John H., Warrenton, Mo.
Foss, E. T., Hydesville, Cal.
Fuller, Edw. N., Tacoma, Wash. T.
Gibson, J. H., Salina, Kans.
Gore, Prof. J. W., Chapel Hill, N. C.
Gray, F. R., Yates Centre, Kans.
Gates, W. B., Burlington, Vt.
Graves, A. B., Belleville, Kans.
Gillingham, Milnor, Fallsington, Pa.
Gardiner, R. H., Gardiner, Me.
Gowey, H. D., North Lewisburg, Ohio.
Green, Dr. Jesse C., West Chester, Pa.
Gerrish, S. H., Sacramento, Cal.
Gray, J. W., Stockham, Nebr.
Goodwin, Wm., North Colebrook, Conn.
Goodspeed, Chas. W., Elyria, Ohio.
Gillingham, W., Accotink, Va.
Garlick, Rev. Dr. J. R., Bruington, Va.
Gray, Capt. A. W., Kenewick, Wash. T.
Grathwohl, John, Blooming Grove, Pa.
Hessler, Robt., Connersville, Ind.
Heath, E. R., Wyandotte, Kans.
Harvard College Observatory, Cambridge, Mass.
Hammitt, John W., College Hill, Ohio.
Harris, T. C., Raleigh, N. C.
Heaton, Isaac E., Fremont, Nebr.
Hoskinson, R. M., Bainbridge Island, Wash T.
Heacock, J. L., Quakertown, Pa.
Hyde, G. A., Cleveland, Ohio.
Haywood, John, Westerville, Ohio.
Hartzler, J. A., Mottville, Mich.
Hole, Joseph, Butlerville, Ind.
Hager, Mrs. L. G., Terre Haute, Ind.
Held, Rev. F. B., Mount Angel, Oreg.
Houghton Farm Experiment Station, Mountainville, N. Y.
Heatwole, L. J., Dale Enterprise, Va.
Hamilton, W. H., Corsicana, Tex.
Hatch, A. H., Windsor, Ill.
Harris, W. C., Dover, N. J.
Humphrey, Dr. L., Fairbury, Nebr.
Hall, J. B. Worcester, Mass.
Hunter, Dr. T. C., Napoleon, Ohio.
Hall, Chas. C., Dudley, Mass.
Horn, Dr. H. B., Atchison, Kans.
Hurlin, Rev. Wm., Antrim, N. H.
Helm, Thos. B., Logansport, Ind.
Ireland, W. H., Rappahannock, Va.
James, John W., Marengo, Ill.
Jones, Dr. E. U., Taunton, Mass.
Jackson Company, Nashua, N. H.
Jordan, Dr. M. D. L., Milan, Tenn.
Kirkwood, E., Manzy, Ind.
Knapp, J. G., Limona, Fla.
Keese, G. Pomeroy, Cooperstown, N. Y.
Kuhne, F. W., Fort Wayne, Ind.
Kent, Miss E. Lily, Phillipsburg, N. J.
Kilpatrick, Prof. J. W., Fayette, Mo.

Observer and place of observation.
Ladshaw, G. E., Pacolet, S. C.
Lucas, Rev. O. W., Pendleton, Oreg.
Lueps, Miss Anna, Manitowoc, Wis.
Lincoln, A. T., Myrton, Va.
Loomis, J. C., Jeffersonville, Ind.
Luther, S. M., Garrettsville, Ohio.
Lovewell, Miss Bertha E., Topeka, Kan.
Lamb, Miss Bertha E., Sterling, Kans.
Loud, Prof. F. H., Colorado Springs, Colo.
Lerch & Rice, Bethlehem, Pa.
Loundes, R. T., Clarksburg, W. Va.
Morgan, L. Ray, Philipsburg, Pa.
Miller, H. D., Drifton, Pa.
McDonogh Institute, McDonogh, Md.
McCready, Miss L. A., Fort Madison,
McKenzie, Dr. M., Centreville, Mo.
Moore, C. R., Bird's Nest, Va.
Micklen, J. H., Variety Mills, Va.
Macrae, Colin, Kirkwood, S. C.
Meehan, Thos., Germantown, Pa.
Moore, Nathan, Grampian Hills, Pa.
Mikesell, Thos., Wauseon, Ohio.
Mitchell, Dr. D. W., Harrisville, Mich.
Moore, Dr. J. W., Easton, Pa.
Motte, L. S., West Milton, Ohio.
McGahan, Dr. C. F., Aiken, S. C.
Newbegin, John D., Anna, Ill.
Newcomb, G. S., Westborough, Mass.
Norcom, Prof. T. J., Reidsville, N. C.
Neal, Dr. J. C., Archer Fla.
Nordberg, A., Richardton, Dak.
Olds, H. D., Cedar Rapids, Iowa.
Owsley, Dr. J. B., Jacksonborough, O.
Osborn, Dr. T. C., Cleburne, Tex.
Penrod, Dr. H. J., Upper Mont Clair, N. J.
Pearce, Thomas, Eola, Oreg.
Peele, Capt. A., New Westminister, B.C.
Partrick, J. M., North Volney, N. Y.
Purdue University, Lafayette, Ind.
Pettersón, Dr. F., Comfort, Tex.
Pendleton, A., Nicolaus, Cal.
Postma, H. Y., Egg Harbor City, N. J.
Piper, F. S., Hanover, N. H.
Robins, Chas. E., Alvah, Fla.
Romig, J. K., La Grande, Oreg.
Randall, E. H., Poultney, Vt.
Renfew, H. N., Bancroft, Iowa.
Remington, C. V. S., Fall River, Mass.
Robertson, T. D., Rockford, Ill.
Rogers, F. M., Luling, La.
Rerick, R. H., La Grange, Ind.
Rodman, T. R., New Bedford, Mass.
Runge, C., New Ulm, Tex.
Richardson, C. F., Beverly, N. J.
Rotch, A. L., Blue Hill Observatory, Blue Hill, Mass.
Rice, Chas. W., Yellow Springs, Ohio.
Roeder, W. F., Zionsville, Penn.
Snell, S. C., Amherst, Mass.
Stone, W. E., Amherst, Mass.
Stern, Jacob T., Logan, Iowa.
Snow, Prof. F. E., Lawrence, Kans.
Smith, H. D., Monticello, Iowa.
Smith, J. R., North Truro, Mass.
Sanders, T. B., Susanville, Cal.
Simmons, Prof. W. G., Wake Forest, N. C.
Slenker, Mrs. E. D., Snowville, Va.
Strong, W. C., Kent's Hill Me.
Shriver, E. T., Cumberland, Md.
Seltz, Chas., De Soto, Nebr.
Scott, Thos. G., Forsyth, Ga.

Observer and place of observation.
Stucky, Dr. C. T., Helvetia, W. Va.
Slade, Elisha, Somerset, Mass.
Shriver, Howard, Wytheville, Va.
Sonedecker, Rev. T. H., Tiffin, Ohio.
Stunkard, L. E., East Brook, Pa.
Sim. J. R., Summit, Va.
Scribner, H. F. J., Strafford, Vt.
Strong, S. B., Setauket, N. Y.
Samostz, Oscar, Austin, Tex.
Sherman, W. B., Manchester, Iowa.
Standenmayer, Dr. L. R., Lincolnton, N. C
Spilman, J. J., Pierce City, Mo.
Swezey, Prof. G. D., Crete, Nebr.
Tilford, C. M., Mount Blanco, Tex.
Talbert, Wm., Emporia, Kans.
Todd, Prof. David P., Amherst, Mass.
Thornton, Prof. N., Geneseo, Ill.
Teele, Rev. A. K., Blue Hill, Mass.
Truman, Geo. S., Genoa, Nebr.
Turnbo, Silas C., Pro Tem, Mo.
Tillinghast, C. B., Albany, N. Y.
Terborg, Rev. J. E., Pekin, Ill.
Trembley, Dr. J. B., Oakland, Cal.
Thompson, R. J., Tiffin, Ohio.
Voegeli, Adolphus, Des Moines, Iowa.
Vail, Hugh D., Santa Barbara, Cal.
Went, E. C., Frankfort, Ky.
Washburn Observatory, Madison, Wis.
Wild, Rev. E. P., Newport, Vt.
Williams, Rev. C. F., Ashwood, Tenn.
Wing, Miss M. E., Charlotte, Vt.
West, Silas, Cornish, Me.
Wylie, Wm., Mount Forest, Canada.
Wait, S. E., Traverse City, Mich.
Woodstock College, Woodstock, Md.
Whittaker, J. S., Corydon, Iowa.
Wolfe, John H., Wellington, Kans.
Wülfke, E. F., Independence, Iowa.
West, Dr. Jos., O., Princeton, Mass.
Washington Aqueduct. — Receiving Reservoir, D.C; Distributing " ; Great Falls Reservoir, Md; Rock Creek Bridge, D. C.
Winipiseogee Lake Cotton and Woolen Manufacturing Co. — Weir's Bridge, N. H.; Woodstock, N. H.; Wolfborough, N. H.; Lake Village, N. H.; Bristol, N. H.; Belmont, N. H.; Ashland, N. H.
Willis, O. R., A. M., Ph. D., White Plains, N. Y.
Watters, Dr. Jas., Westmoreland, Kans.
Wigg, Dr. Geo., East Portland, Oreg.
Wright, J. W. A., Greensborough, Ala.
Whitmore, J. E., Gallinas Spring, N. Mex.
Wadsworth, Dr. J. L. R., Collinsville, Ill.
Widman, Rev. C. M., Grand Coteau, La.
Williams, Dr. A. C., Elk Falls, Kans.
Wedge, J. C., Fond du Lac, Wis.
White, Rev. J. H., Merritt's Island, Fla.
Whitney, Chas. E., Humphrey, N. Y.
Wilson, W. T., Clayton, N. J.
Wood, Jos., Bar Harbor, Me.
Walton, J. P., Muscatine, Iowa.
Wearmouth, J., University of Virginia, Va.
Waterman, Wm., Hay Springs, Nebr.
Woodruff, Dr. S. E., Clyde, Ohio.
Yetter, Wm. G., Catawissa, Pa.
Yates, T. P., Factoryville, N. Y.
Young, Geo. R., Penn Yan, N. Y.
Zimmerman, F. C., Bunker Hill, Ill.

Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for August, 1886.

Alcatraz Island, Cal.	Concho, Fort, Texas.	Keogh, Fort, Mont.	Monroe, Fort, Va.	Robinson, Fort, Nebr.	Supply, Fort, Ind. T.
Angel Island, Cal.	David's Island, N. Y. H.	Lowell, Fort, Ariz.	McDowell, Fort, Ariz.	Reno, Fort, Ind. T.	Totten, Fort, Dak.
Assinaboine, Fort, Mont.	Ellis, Fort, Mont.	Laramie, Fort, Wyo.	McHenry, Fort, Md.	Riley, Fort, Kans.	Townsend, Ft., Wash. T.
A. Lincoln, Fort, Dak.	Fred Steele, Fort, Wyo.	Lewis, Fort, Colo.	Mount Vernon B'ks, Ala.	Snelling, Fort, Minn.	Union, Fort, N. Mex.
Benicia Barracks, Cal.	Gaston, Fort, Cal.	Meade, Fort, Dak.	Niagara, Fort, N. Y.	Saint Augustine, Fort, Fla.	Washakie, Fort, Wyo.
Bidwell, Fort, Cal.	Gibson, Fort, Ind. T.	McKinney, Fort, Wyo.	Niobrara, Fort, Nebr. {Cal.	Sisseton, Fort, Dak.	West Point, N. Y.
Brady, Fort, Mich.	Halleck, Fort, Nev.	McIntosh, Fort, Tex.	Presidio of San Francisco,	Shaw, Fort, Mont.	Walla Walla, Ft., Wash. T.
Boisé, Fort, Idaho.	Hays, Fort, Kans.	Missoula, Fort, Mont.	Plattsburg Barracks, N. Y.	Selden, Fort, Nebr.	Wingate, Fort, N. Mex.
Cœur d'Alene, Ft., Idaho.	Huachuca, Fort, Ariz.	Mason, Fort, Cal.	Pembina, Fort, Dak.	Sully, Fort, Dak.	Yates, Fort, Dak.
Columbus, Fort, N. Y. H.	Klamath, Fort, Oreg.	Madison Barracks, N. Y.	Randall, Fort, Dak.	Sidney, Fort, Nebr.	

State weather services from which meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for August, 1886.

Alabama State Weather Service, under direction of Prof. P. H. Mell, Jr., Auburn, Alabama.
Georgia State Weather Service, under direction of Hon. J. T. Henderson, Commissioner of Agriculture, Atlanta, Georgia.
Indiana State Weather Service, under direction of Prof. H. A. Huston, La Fayette, Indiana.
Indiana State Weather Service, under direction of Prof. W. H. Ragan, Greencastle, Indiana.
Iowa Weather Service, under direction of Dr. Gustavus Hinrichs, Iowa City, Iowa.
Missouri State Weather Service, under direction of Prof. Francis E. Nipher, Saint Louis, Missouri.
Nebraska Weather Service, under direction of Prof. Goodwin D. Swezey, Crete, Nebraska.
New England Meteorological Society. Prof. Winslow Upton of Providence, R. I., President; Mr. W. M. Davis, of Cambridge, Mass., Secretary.
Ohio State Weather Service, under direction of Prof. B. F. Thomas, of the Ohio State University, Columbus, Ohio.
Tennessee State Weather Service, under direction of Major H. C. Bate, Nashville, Tennessee.

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STANDARD METEOROLOGICAL INSTRUMENTS, APPARATUS, TEXT-BOOKS, FORMS, AND PUBLICATIONS.

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Common pattern and finish, vernier reading to 100th inch, in pine box:			
Reading down to 26 inches	$30.00	Packing and shipping by express,	$2.50
do. 24 do.	31.00	do.	2.50
do. 22 do.	32.00	do.	2.50
do. 14 do. (two verniers)	53.00	do.	2.50
Common pattern and finish, vernier reading to 1,000th inch, in pine box:			
Reading down to 26 inches	$34.00	Packing and shipping by express,	$2.50
do. 24 do.	36.00	do.	2.50
do. 22 do.	40.00	do.	2.50
do. 14 do. (two verniers)	54.00	do.	2.50
Best pattern and finish, vernier reading to 1,000th inch, in pine box:			
Reading down to 26 inches	$36.00	Packing and shipping by express,	$2.50
do. 24 do.	38.00	do.	2.50
do. 22 do.	42.00	do.	2.50
do. 14 do. (two verniers)	55.00	do.	2.50
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Marine barometer	33.00	do.	2.50
Mountain barometer, two verniers, in leather case, to 20,000 feet	65.00	do.	2.00
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Barometer tube (glass)	1.25	do.	1.00
Barometer tube, filled and replaced	8.00	do.	2.50
Barometer cistern, complete	4.25	do.	.60
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Thermometer for dry or wet-bulb	$ 3.00	Packing and shipping by express,	$ .60
do. wet-bulb, support for	.50	do.	.25
do. do. cup for	.50	do.	.25
do. dry-bulb, support for	.15	do.	.25
do. maximum registering	5.00	do.	.60
do. minimum do.	4.00	do.	.60
do. solar radiation	10.00	do.	.75
do. terrestrial radiation	7.00	do.	.60
do. small, in metal case, for pocket, engraved stem	2.50	do.	.25
do. water	3.00	do.	.60
L. R. 11347, P. D., 1882.			
Anemometer, "Robinson's," (velocity)	$22.50	Packing and shipping by express,	$1.10
Electrical recording apparatus, "Gibbon's," (velocity). (L. R. 4315, P. D., 1886.)	34.00	do.	1.10
Anemometer blanks (L. R. 5627, P. D., 1886)		per hundred...	1.00

*Furnished by the Hahl Manufacturing Company, 13 Mercer Street, Baltimore, Maryland,**

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* L. R. 11303, P. D., 1882.

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do. large	65.00	do.	5.00
do. "Eckard's" attachment for use with anemograph	10.00	do.	——
do. base for anemograph	10.00	do.	——
Anemometer, telescopic rod for, new pattern	57.00	do.	3.00
L. R. 11327, P. D., 1882.			

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do. 107 E,	do.		1.60
do. 107 F,	do.		1.75
do. 107 G,	do.		2.20
do. 107 H,	do.		1.60
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L. R. 13397, P. D., 1885.			

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L. R. 4321, P. D., 1883.	

Furnished by John Schultzbach, 634 G Street N. W., Washington, D. C.

Rain-gauge, standard 8-inch Signal Service*	$5.00
Rain-gauge, galvanized iron, with overflow and measuring-stick	2.50
Rain-gauge, copper, with galvanized iron overflow and measuring-stick	1.50
Measuring-sticks, extra	.25
Farmers' weather case	54.70
Case for water thermometer	7.50
L. R. 4051, P. D., 1883. * L. R. 11275, P. D., 1885.	

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Rain-gauge, standard 8-inch, Signal Service	5.00
Whirling apparatus (L. R. 7965, P. D., 1886)	5.00

Furnished by Property and Disbursing Officer, Signal Service, U. S. A., Washington, D. C.

Maps in one color without reports or isobaric lines, each	.015
Maps in one color, without reports or isobaric lines (as used on cyclostyle at Signal Service stations), each	.015
Maps on manifold paper without reports or lines, in books of 100, per book	2.75
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